

POPULAR SCIENCE

MONTHLY

JULY
15 CENTS

20 CENTS IN CANADA



NOW
15¢
20 CENTS IN CANADA



SEE PAGE 33

NEW INVENTIONS • MECHANICS • MONEY MAKING IDEAS
HOME WORKSHOP PLANS AND HINTS • 350 PICTURES

MARFAK gives true fluid-film lubrication!



Texas Marfak liquefies under pressure and rolling action, supplying correct fluid-film lubrication. But the undisturbed Marfak retains its cohesive qualities and acts as a seal to keep this fluid film in the bearings.



"KNEE ACTION" front suspensions demand special attention. There are many more joints-bearings to lubricate. There is nothing like Marfak for the safer lubrication and longer life of these parts.



TEXACO
Certified
SERVICE

Pressures on the king pin and steering connections are tremendous. Save these bearings with Marfak. They float on Marfak—which means surprisingly easier steering and the greater driving comfort in the certainty that everything is safe. It's a film of protection that can't be broken.

Marfak resists water. It provides an effective seal against dust and dirt and gives extraordinarily effective

lubrication. Marfak lasts three times as long as ordinary greases.

It will pay you to drive to a Texaco Certified Station for Marfak lubrication for shackles, wheel bearings, universal joints, and steering system. You'll appreciate its value in the savings, and in the quieter action of your car.

THE TEXAS COMPANY • *Texas Petroleum Products*

THE TEXAS COMPANY IS THE ONLY COMPANY THAT MAKES MARFAK

COPYRIGHT 1934, THE TEXAS COMPANY

TEXACO *Certified* LUBRICATION



"Building a Canal—or Buying a Car—Good Engineering Counts"



A CERTIFIED INTERVIEW WITH CONSTRUCTION ENGINEER FRANK VIOLETTE ★



"We punish cars down here...but let me tell you how my Plymouth takes it"

FRANK VIOLETTE is a modest man. He talks very little about his supervising millions of dollars' worth of Panama's construction. But ask him about cars...

"In the Canal Zone, our everyday driving soon proves how well a car can take punishment. I've found that of all the low-priced cars, Plymouth stands up best."

And Mr. Violette isn't surprised that Plymouth proved to be the strongest. As an engineer, he knows from experience that steel re-

inforced with steel is the safest form of construction.

But Plymouth engineers didn't stop with this one safety feature. They also gave Plymouth Hydraulic Brakes—the safest brakes made.

Then, they built in extra comfort, too... with patented Floating Power engine mountings to deaden motor vibration... and Individual Wheel Springing to smooth out the roughest, rattiest roads.

Any Dodge, De Soto or Chrysler dealer will demonstrate Plymouth.

1. "We depend on steel for safety in the Canal and in our buildings. We've found it's positive proof against everything from termites to earthquakes. So I knew that, in a car, a Safety-Steel Body would be the strongest."



2. Mr. Violette and Mr. Martinez, President of the construction company with which Mr. Violette is associated, each with his De Luxe Plymouth. Plymouth prices begin at \$530 at the factory. Time pay-

ments to fit your budget. Just ask for the Official Chrysler Motors Commercial Credit Plan. Duplicate Safety Plate Glass throughout at the lowest extra cost in the industry (only \$10 on the De Luxe Sedan).

PLYMOUTH \$530

AND UP
AT THE FACTORY
DETROIT

IT'S THE
BEST ENGINEERED
LOW-PRICED CAR

RAYMOND J. BROWN, Editor
ARTHUR WAKELING, Home Workshop Editor
ALDEN P. ARMAIGNAC, Associate Editor
SYDNEY OXBERRY, Art Editor

POPULAR SCIENCE

MONTHLY

VOLUME 125 • NUMBER 1
15 Cents a Copy • \$1.50 a Year
Published Monthly by
Popular Science Publishing Co., Inc.,
381 Fourth Ave., New York

TABLE OF CONTENTS for JULY, 1934

New Foods From the Test Tube 13

EDWIN TEAL tells how the vigilance of nutrition experts guards our health

Thousand-Mile Lightning Rod Protects Greatest Power Line . . . 16

Resourceful engineers at Boulder Dam perform electrical marvels

Dare-Devil Tricks of Racers Make Your Driving Safer 24

Lessons learned by an automobile champion under fire, described by FRED FRAME

Barren Alkali Lands Made Fertile 28

ANDREW R. BOONE relates how blighted farms are reclaimed by chemists

Raccoons for Hunters Grown on State Farm 36

Thrills and problems of breeding wild game detailed by GROVER C. MUELLER

Learn the New, Correct Language of the Air 40

ARTHUR GRAHAM writes a guide to the strange idiom flyers now speak

Strings and Magnet Show How Meteors and Comets Travel . . . 47

Secrets of the sky's most mysterious bodies revealed by GAYLORD JOHNSON

Army Recruited from Idle Men Fights Fire and Flood 49

ROBERT E. MARTIN tells how CCC workers find fun and adventure while saving our forests

FEATURES AND DEPARTMENTS

A New Face for Your House . . .	6
Insects Under Microscope . . .	38
The Man with the Net	45
New Devices for the Household .	58
Making Acids Safely at Home . .	60
Hints for Radio Fans	63
Two-Tube Set Has One Tube . . .	64
Compact Short-Wave Set	65
How's Your Driving Eye?	66
The Home Workshop	67
Vacation Picture Books	82
The Month's Best Auto Ideas . .	84

Cover design by EDGAR F. WITTMACK

AUTOMOBILES

Auto Brakes Self-Cooled	32
Deadly Gas Piped Out of Garage .	42
Moving Floor Unloads Garbage .	44
Illuminated Hub Cap	46
Runners Coached from Auto . .	55

AVIATION

Ladders for Airship Work . . .	19
Planes Air-Conditioned	21
Deaf May Seek Cures in Air . . .	31
Quarry Plane for Blind Flying .	22
Pneumatic Tubes Speed Air Mail .	30
15-Foot Plane Has 120-Mile Speed .	32
Steam Turbine for Airplanes . .	32
Glider Propelled by Foot Power .	34
Land Catapult Launches Plane .	54

July, 1934, Vol. 125, No. 1.
Popular Science Monthly is published monthly at 381 Fourth Avenue, New York, N. Y., by the Popular Science Publishing Co., Inc. A. L. Cole, President and Treasurer; R. C. Wilcox, Vice President; John Nichols, Vice President; F. W. Briggs, Sec'y. Entered as second-class matter Oct. 28, 1915, at the Post Office at New York under the act of March 3, 1879, additional entry as second-class matter at Dayton, Ohio, entered as second-class matter at the Post Office Department, Canada, printed in U. S. A. Copyright, 1934, by the Popular Science Publishing Co., Inc. Single copy, 15 cents; 12 issues in Canada, 1.50; foreign countries, including Canada, \$2.00. Subscribers must notify us of change of address four weeks in advance of the next publication date. Be sure to give both old and new address. The contents of this magazine must not be reprinted without permission. The editors are not responsible for unsolicited contributions, and cannot guarantee the return of such material or insure against its loss. Contributions not accompanied by sufficient postage will not be returned. In accepting numerous stories of new products of applied science, Popular Science Monthly does not underwrite the business methods of the individuals or concerns producing them. The use of Popular Science Monthly articles for stock-selling schemes is never authorized.

Don't worry...I won't
bring him again



"The man who doesn't keep clean shaven is *never welcome*"

SAYS ALICE-LEONE MOATS, FAMOUS AUTHOR OF "NO NICE GIRL SWEARS"



Alice-Leone Moats

Of course he isn't welcome. Who could make a good impression with a growth of stubble on his face! Most men know this is true—yet far too many are careless about shaving.

If there is any doubt that shaving is essential in keeping the respect of others, listen to the words of Alice-Leone Moats. Famous authority on modern manners, Miss Moats brought etiquette up to date in her sensational best-seller, "No Nice Girl Swears." She knows the woman's viewpoint—has helped thousands to get along with others—win new friends and keep old ones.

Says Miss Moats: "No woman cares to entertain or be seen with a man who neglects shaving. He may think he is getting away with it—but the truth is, a careless shave only too clearly implies that the offender thinks so little of his hostess that he cannot be bothered about his appearance. In fact, failure to shave carefully is an affront that women simply will not overlook."

Why take a chance on stubble when shaving is so quick and easy with today's Gillette "Blue Blade"! At the new low prices you can afford to change blades frequently and make every shave a perfect shave. Just try this and see. You will agree that the comfort and satisfaction you get can not be measured in pennies.

If you haven't a Gillette razor ask your dealer for the "Red and Black" special or see coupon below. Remember—the Gillette Razor with its flexible blade is adjustable to the special requirements of your beard. Without this essential feature no razor can be entirely satisfactory.



Gillette

BLUE BLADES

Now **5 FOR 25¢**
10 FOR 49¢

Gold-Plated Gillette Razor and 5 Gillette "Blue Blades" Only 49c

● Heavily gold-plated with new-style "bushy" handle. Comes in handsome red and black case with 5 Gillette "Blue Blades." If your dealer cannot supply you, send coupon and 49 cents to:—
The Gillette
Safety Razor Co.
Boston, Mass.

Name _____

Address _____

City _____

State _____



Razor Case and Blades on the air every night except Saturday and Sunday. WEAF and coast-to-coast hook-ups 6:15 P.M. E.T. or 9:15 C.S.T.

POPULAR SCIENCE MONTHLY FOR JULY, 1934

Racing Electric Planes New Game	56
Plane Has Retractable Wheels	57

MODELS

Color Animal Models in Cast	62
Ship Mooring Taught with Model	46
Electric Steamboat Model	57
Small Ship Models in Sets	76
Whittled Model of Monoplane	81
Accessories for Model Buildings	105

NEW DEVICES FOR THE HOUSEHOLD

Disappearing Cord	58
Air Whips Cream	58
Electric Buffer	58
Safety Wringer	58
Clothes Basket on Pulley	58
Air Cooler	58
Handy Assistant for Cook	59
Touch Opens Door	59
Turntable for Graver	59
Adjustable Stepladder	59
Incense Candles	59
Wire Bottle Holder	59
New Paper for Kitchen	59

NEW PROCESSES AND INVENTIONS

New Light for Microscope	18
Japan's Mystery Two-Man "Sub"	18
Passenger's Car Powers Ferry	19
Clock Tells Time at Any Point	19
Sailboat Has Spinning Sails	19
Stands for Picnic Dishes	19
Electric Fan Freshens Boxes	20
Giant Generator Smashes Atoms	21
House on Wheels Moved by Auto	23
Robot Prevents Jail Breaks	27
Diesel Train Has 125-Mile Speed	30
Rotating Jar Displays Food	30
Cathode Rays Guard Ships in Fog	31
Lamp Gives Unbroken Line of Light	31
Phonograph Uses Paper Records	31
Surface Cables Heat Hotbeds	32
Amphibian Cars for Monorail	33
Car Beats Driver's Scarf	33

Flashlight Cells Run Vibrator	34
Dropping New Match Puts It Out	34
Divining Rod Hunts Gold	34
New Printing Uses Typewriter	35
Sled Cages Explorer's Travel	35
New Adjustable Flashlight	43
Home Fingerprint Outfit	43
Graphite Gun for Home Use	44
Hat Weighs Ounce and Half	44
Greenhouse in Sections	45
Pump to Keep Bait Alive	45
Wire Reproduces Voice	46
Spring Winder for Home Shop	46
Barrel House Completed	54
Foot Paddles Speed Swimmers	55
Air Pump Helps Build Bridge	56
Beam Tests Shooter's Nerve	57

RADIO

Pen Reproduces Radio Pictures	43
Ultra-Short Waves Speed Plates	54
Broadcast from Diver's Mask	55

PHOTOGRAPHY

Camera Gun to Trap Crooks	33
High Voltage Glow Photos	43
Infra-Red Photos of Veins	55
Separate Exposures from Film Roll	103

UNUSUAL FACTS AND IDEAS

Rangers Trail Fire Bugs	18
Luck Naps Serpent Just a Whale	18
Gale Sets 231-Mile Record	20
Hats Protect Roses at Show	32
Invents Puzzles as Hobby	34
Two Men Shm from Cannon	35
Tail Lights for Hikers	42
"Wire" Fence Grows Wild	42
Masked Corps for Sewer Rescues	44
Dynamite Destroys Ant Colony	45
Water Pipe Big as Locomotive	45
Ingenuous Dental School Tests	53
Tags Bats to Study Habits	54
Mule's Jawbone as Banjo	54
Paper Bags Preserve Dried Milk	55

First Aid Kit in Sign Post	55
Gas Guns Take Animals Alive	56
Trap Electrocutes Rats	56
Chains Hold Gibraltar	56
9,000-Year-Old Ax	57
Cable Saves Life Guard	57
Science Stunts in Your Home	62
Colored Underwater Lights	71
Neon Tube Experiments	75

CRAFTWORK

Panels Decorate Cigar Boxes	70
Knocker of Hand-Wrought Iron	72
Carving with Jig-Saw and Sander	73
Dog Leashes and Watch Guards	76

WOODWORKING

Picturesque Spanish Table	60
Theor Novelties from Lath	86
Home Workshop Blueprints	88
One Construction Kits	98
Few Tools Build Sewing Table	103

IDEAS FOR THE HANDY MAN

Pepping Up Outboard Motor	67
Holder for Thermometer	70
Boat Dock Folds Back	70
Routing Sheet Metal	70
Picture Frame Clamps	72
Screens for Steel Casements	72
Homeworkshop Guild News	74
Cushioned Back Pack	77
Relay Stops Model Railway Crashes	77
Coconut Bird Serves as Ash Tray	80
Extra Seats for Bridge Parties	80
Soet Holder for Birds	80
Folding Pocket Ash Tray	92
Small Slip-Proof Step Ladder	92
Filling Edge Makes File Safe	92
Rods to Stir Liquids	94
Shade Protects Books from Dust	94
Canoe Seat Makes Paddling Easier	95
Using Wire Drawing Plates	95
Spring Raises Bicycle Stand	104
Cart Hooks as Footstool Feet	107



AMERICA LEADS IN TELEPHONE SERVICE

The telephone was invented in this country and it has reached its highest development here. There are six times as many telephones in relation to population in the United States as in Europe and the service is better.

This high efficiency did not just happen. It is the result of American initiative and a sincere desire to serve the public. Back of it all you see the value of the structure and the fundamental policies of the Bell System.

This system functions in the best interests of the telephone user because it combines and

unifies the essentials of efficient telephone communication—research, engineering, manufacture, supply and operation. There is no pulling at cross-purposes or waste through an overlapping of activities. Everything is co-ordinated to give you the best telephone service at the lowest possible cost.

The general plan of the Bell System is the cumulation of more than fifty years' experience, resulting in one policy, one system and universal service.

BELL TELEPHONE SYSTEM



Every Car Should be SIMONIZED

If you want your car to stay beautiful, the sooner you Simoniz it, the better! New or old, every car needs Simoniz to protect the finish from weather and dirt—to make it last longer, and keep colors from fading.

Millions say there's nothing like Simoniz and Simoniz Kleener for keeping cars beautiful. So, always insist on and get them for your car.



EASIER • QUICKER • SAFER

A few easy strokes with the wonderful Simoniz Kleener makes dull cars sparkle like new. Restores the luster, safety and security. Then apply Simoniz. It protects and keeps the finish beautiful for years.



By
**R. M.
BOLEN**

Secretary Popular
Science Institute

Left, a frame house in need of repair and to which a rejuvenating brick veneer can be applied at slight cost. Below, renewing a house by using a recently developed asbestos and cement siding to imitate a real brick wall.

Giving Your House a New Face



HAVE you ever thought of rejuvenating your house by changing its outer finish? House face lifting is a painless and inexpensive way of satisfying that urge to own a new home.

For instance, it requires no great amount of time or money to change an old-style frame building into a modern stucco or brick home or to transform a stucco house into what appears to be a brick dwelling. New materials and methods make it easy to change the entire appearance of a home merely by encasing its walls in a decorative overcoat.

One popular way of modernizing a frame building is to apply a long-wearing outer coating of cement stucco, either colored or white and trowelled or brushed to give any one of a dozen different textures to match the architecture. According to average figures, a three-layer overcoating of stucco on metal lath can be applied to an old building for approximately \$1.55 a square yard including the labor. Of course, in some localities this price will vary.

In preparing a frame structure for a stucco overcoating, the trim is first ex-



This is the same house, shown at top of page, after it was modernized with a new exterior of brick veneer and a porch.

tended to take care of the additional thickness of the finish. Then a layer of substantial building paper is applied and metal lath fastened over this with lurring nails to hold it away from the original wall.

To provide a good base and anchor for the new stucco wall, the first or scratch coat is pushed through the holes in the wire mesh lath so that it forms a solid mass against the waterproof weather paper. In most cases, this first coat is made half an inch thick and is laid so that it completely covers the outside of the lath.

When this first coat has been cross-scratched or scored to provide a bond, and has been allowed to dry, it is wetted down and the second, or brown, coat is applied. After a thorough drying, the second coat is then covered with the finish coat which may vary in thickness from

one eighth to one quarter of an inch depending on the texture of the finish.

All three coats consist of the same mixture made in the proportions of five sacks of high-grade cement to fifty pounds of hydrated lime and sixteen cubic feet of sand. Of course, if a color is desired, a mineral pigment is added to the mix for the finish coat.

ANOTHER popular type of modernizing, or renovating, finish consists of an overcoating of real brick laid flat to give a veneer four inches thick. Built over the old wall, this real brick exterior completely changes the appearance of the house and ends the painting problem forever. Based on the average cost of face brick and labor, an overcoating of this variety can be applied for approximately \$1.93 a square yard.

Unlike stucco overcoatings, a veneer of face brick is not applied directly to the weather-papered siding but is spaced at least an inch from it. This provides an insulating air space between the old wall and the new and takes care of any irregularities in either the brick or the siding. Since a brick wall may weigh thousands of pounds, it is necessary, of course, to provide a separate foundation of concrete footing at the base of the new outer wall as well as angle-iron supports over all openings such as windows and doors. Some form of anchorage also must be supplied to hold the narrow brick wall steady and in place. In most cases, thirty-penny nails driven into the studs and imbedded in the bond between bricks serve as the anchors.

Besides these full stucco and real brick overcoatings, there are several novel imitation brick veneers and shingle sidings that can be used to change the exterior of a frame or stucco house. Roughly, these imitation coverings can be divided in to three classes—a new asbestos and cement siding manufactured in strips imitating three standard red or gray bricks laid in a row, a shingle type of asbestos siding that gives the general effect of bricks, and a recently developed half-inch brick veneer manufactured in panels of twelve imitation bricks each equaling approximately two square feet of wall area. In this last mentioned type, the imitation bricks are mounted on a high-grade insulating board and regular brick mortar is used to close the joints between panels.

When applying these sidings, building paper or felt is applied first and the brick strips, shingles, or panels are nailed directly to the building. Prices for labor and materials for this type of exterior range from \$1.00 to \$2.50 a square yard.

THE process of changing the general outside appearance of your house also presents the possibility of altering any undesirable features in the architecture to give a more modern effect. A building carpenter will not find it difficult to eliminate a dormer, fill in an unwanted window, or change the position or general construction of a porch or entrance.

Aside from the beauty of these overcoats of stucco, real brick, or imitation siding, they have many other advantages, since they provide additional insulation and tend to cut down fuel bills, provide added safety from fire, and increase the resale value of the property.

MOTOR OIL THAT SPEEDS NEW SUPER-TRAIN MAKES ALL CARS GO FASTER!



ALSO INCREASES PICK-UP 10 TO 25%

**Available Now at
No Extra Cost to Public**

LOOKING for something to pep up your car—to give it more snap on the getaway—to cut down gas consumption?

Then try Tough Film Pennzoi—the special motor oil that car owners everywhere are talking about.

A Record-Breaking Oil

Here's proof that the correct grade of Pennzoi makes cars go faster. Ab Jenkins used Pennzoi—a regular, light-grade—when he drove his Pierce-Arrow over salt beds of Utah. Averaging 118 miles an hour for 3000 miles! Breaking 14 world records!

The Union Pacific Railroad uses Pennzoi to lubricate its new streamline super-train that has a top speed of 110 miles an hour!

More than 50% of fast air transport miles are now flown with Pennzoi exclusively.

And thousands of motorists tell how the correct grade of Pennzoi gives their cars more speed... increases pick-up... saves money on gasoline.

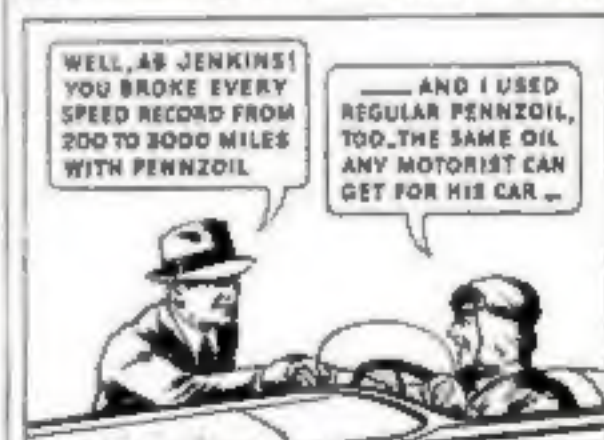
What Pennzoi is

Pennzoi is refined from the finest Pennsylvania crude. It is 3 times concentrated to give it an amazing tough film that can withstand the terrific punishment of record-

breaking speeds. Then, the non-lubricating elements found in many plain oils are removed from Pennzoi. This cuts down internal friction or engine drag... as effectively as streamlining cuts down external wind resistance. Thus your motor runs smoother, easier, faster... and you save on gasoline.

Try Pennzoi Today

Remember, this special motor oil costs no more. But think how much more it gives you. More speed. Quicker pick-up. And big gas savings. So why be satisfied with any other oil. Get Pennzoi today from any bonded Pennzoi dealer.



THE PENNZOIL COMPANY
Executive Offices: Oil City, Pa. — Los Angeles, Calif.
British-American Oil Co., Ltd., Canada.

**TOUGH
FILM**

PENNZOIL

PENNZOIL
Safe Lubrication

MAKES CARS GO FASTER... SAVES ON GASOLINE

Member Penn Grade
Crude Oil Ass'n. Pennzoi No. 8

Our Readers Say



Here's A Chance to Build Your Own X-Ray Machine

RECENTLY in *Our Readers Say* I read a request for a cheap, homemade X-ray machine. As I have often thought of building such a machine, I took the liberty of discussing the problem with a famous X-ray specialist in Philadelphia. As a result I pass on the following information:

The tube itself offers no difficulties and any glass blower will help you complete it. The necessary vacuum, however, is the discouraging part. Not only must the vacuum be very high but even the air in the metal must be withdrawn. To do this the tube must be kept in a hot oven while the vacuum is being drawn and a constant current of high voltage must be shot through it. By this process, the air is drawn from the metal which otherwise would cause considerable fluorescence and hinder the X-rays. I believe any fairly experienced worker could construct the apparatus as shown in the accompanying sketch and then have the vacuum drawn by some responsible company.—E. L., Philadelphia, Pa.



Carved-Light Apostle Is Hereby Set Right

IN A recent issue of *POPULAR SCIENCE MONTHLY* A. H., Glen Ellyn, Ill., proposes a theory that light from a moving source comes in a curve. He uses the analogy of a moving hose spouting out water. This is a good comparison, I think, but he has misconstrued it a bit. The stream of water would be a curve, but close observation would show that each drop of water goes in a straight line from the point where the nozzle was at the time when that drop issued forth to whatever point it strikes (ignoring, of course, the downward curve caused by gravity). In the same manner the beam of light would, if you could see the entire thing, be a curve; but the individual wave fronts of the light would follow a straight line from the point where the source was at the time when it left. I think, and I hope, A. H. will agree with me in this.—R. C. B., Scarsdale, N. Y.

Single-Tube Receivers Seem Suddenly in Big Demand

THIS letter is written for the one purpose of agreeing with M. P., of Brooklyn, N. Y., and A. B., of Corning, N. Y., who want information on the construction of Tesla coils and high-frequency apparatus. And another thing: What are the chances for some articles on the construction of single-tube receivers, both long and short waves? Radio has been developed to such a point that one tube can give comparatively good reception. I've been a steady reader of your magazine for many years and you'll always have a steady reader until my death notice appears. More power to you.—G. R. S., Portland, Ore.



Streamlined Auto Doors Demanded by This Reader

I LIKE streamlined automobiles, but why in the name of aerodynamics are the doors not designed with streamlining also? The front doors on many cars open forward, and a headwind will tend to close them or to hold them closed. But the rear doors on most cars open backward, so that a head wind would blow against the door, if the door were open. Why not have all four doors opening forward, in a streamlined manner? I have never seen a car of this design but it seems to me it would be an excellent type.—J. G. C., Sonora, Texas.

Do You, Too, Want Articles On Infra-Red Photography?

I HAVE been for some time an enthusiastic follower of your articles on phases of photography, and they have all been very helpful to me. However, I feel there are some branches yet to be covered, and I am quite sure information on these subjects would be welcomed. Would it be possible to publish an article dealing with infra-red and ultra-violet photography? The article should deal not only with the taking of the pictures but with the manipulation of the materials in the dark room. Also, could some notes on the handling of panchromatic material be included? I would, and I am sure others would echo my feelings, very much appreciate an article of this sort and I do hope you heed my request.—L. R. L., Webster Grove, Mo.



atmosphere immediately above the earth profits by the radiated heat and is further heated by the dissipation of the energy reflected from the earth.—S. T., Nashville, Tenn.

How Many Readers Approve This Violin-Making Idea?

I AM a subscriber to your magazine, and do not think it out of place to suggest that you include in your magazine an article on the rudiments of violin making. I am interested in this subject and feel sure you have many readers who would appreciate articles on the subject of violin making as much as I should. If you give favorable consideration to my request I would appreciate an article on the above subject at an early date.—S. M. H., Beach City, Ohio.



No Permanent Waves in This Reader's Gravity

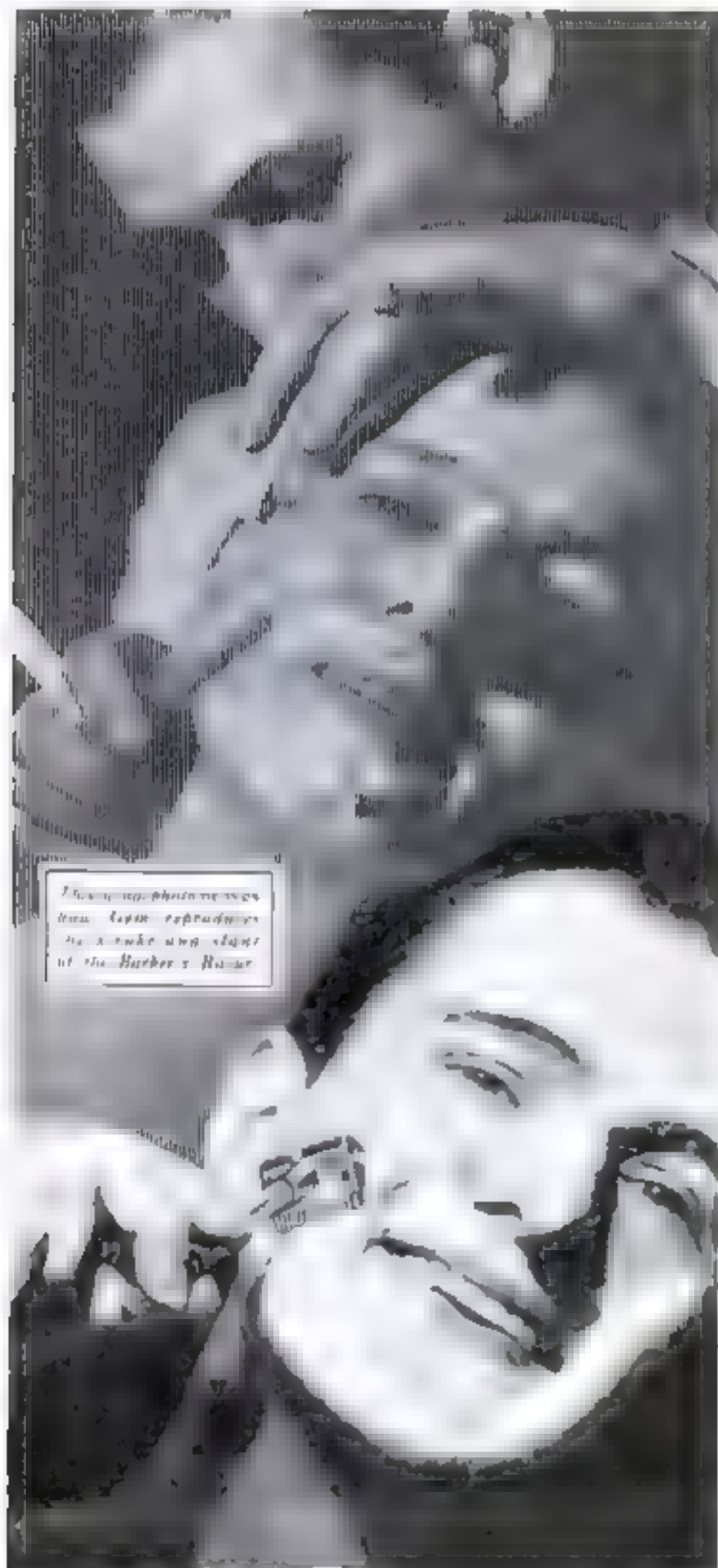
SINCE when, R. N. L., Seattle, Wash., does gravity have waves? Newton's idea of gravity was this: that every portion of matter attracts every other portion with a force directly proportional to the product of the masses, and inversely proportional to the square of the distance between them. He mentions nothing about waves in his statement. If there were gravity waves they would have velocity and would push things away from the earth instead of holding them down. Gravity is independent of such things as material of the bodies, nature of intervening space, and shape of the bodies. It depends only on distance and mass.—J. D. H., Memphis, Tenn.

With Prohibition Gone, Now Comes This Cure for Hiccoughs

SOME time ago a physician reported to the American Medical Association a cure for hiccoughs that I have never happened to see in your interesting magazine. Since it has worked like a charm on several of my friends and myself, I should like to pass it along for the benefit of anyone who may be interested. The only apparatus required is an ordinary paper bag of medium size. At the onset of a fit of hiccoughs, the mouth of the bag is held closely over the nose and mouth. The user slowly inhales and exhales into the bag, taking care that it does not leak; the paper will crackle when this is done correctly. In a few minutes the hiccoughs will cease and the bag may be removed. I believe the slight excess of carbon



Gem alone works with a *Barber Stroke*



Gem doesn't scuff the skin with short, choppy, *stubble-twisting* strokes. It *slides* through the toughest whiskers with the velvet action of the barber's razor, because it *also* uses wedge-edge, *rigid* blades in a straight, *full contact* holder.

Gem's design *compels* correct shaving. Its bevelled top meets the bristles at *root-level* and right angles and removes the beard in swift, tugless, *face-length* glides. Like the barber's stretching fingers, Gem tightens folds and wrinkles, reaches hairs that *wrongly-shaped* razors *miss*, and leaves clefts and nostril contours clean as a whistle.


Dual Alignment (patented feature) sets the blade so accurately and *unbudgingly* that you *can't* rasp or nip your face.

We build Gem Blades of super-tough, 50% *thicker* surgical steel, and strop 'em 4840 separate times for *long* use on *strong* beards. They remain keen so *indefinitely* that economy scowls at the money wasted on softer, thinner, *shorter-lived* substitutes.

Gem Micromatic Razors are fool-proof and guaranteed *forever*. One piece—adjusted with a twirl—cleaned in a jiffy. Handsomely boxed sets sold everywhere at \$1. Or a regular dollar holder with two blades to any "Doubting Thomas" who'll *spend* a quarter and *send* this coupon.



Gem Safety Razor Corp.,
Dept. PS23, Brooklyn, N. Y.

EST. S. R. C. 1934 

Enclosed find 25¢ for complete trial Gem set with a single- and a double-edge blade and the same gold-plated Gem Micromatic Razor now featured in regular \$1 outfit.

PRINT NAME _____

ADDRESS _____

GEM MICROMATIC *Razor and Blades*

dioxide accumulated in the bag is considered responsible for the cure. I have seen this treatment fail only once in a dozen or more cases of severe and painful hemorrhaging.—F. G. B., Topeka, Kan.

He Likes Any Article As Long As It's On Astronomy

IN A recent issue of POPULAR SCIENCE MONTHLY appears the most interesting article that you have printed since "Blast of a Giant Atom Created Our Universe." (P. 5, M., Dec. '32, p. 28.)

The article in question is "Saturn's Rings and Mars' Canals." Both of these articles are on astronomy and as I am a student of astronomy, they helped me a great deal. The whole magazine does, as a matter of fact. I cannot see how anyone can dislike astronomy.

Personally I think anyone that does is abnormal. There is no subject that makes a person think as much as astronomy does. Another good article you printed recently is entitled "Power Hidden In Atom." Let's see more astronomy in your magazine.—W. B. Folcroft, Pa.

Sound Waves Focused By a Transparent Bag

YOUR June article on new researches in sound recalls an odd bit of experimentation carried on years ago. I wonder if your readers know of it. A scientist in Europe constructed a bag of transparent cellulose material, shaped it like a convex lens and filled it with carbonic acid gas. When he passed sound waves through it, they converged just as light beams are focused by a glass lens. The reason was that the sound waves, traveling through carbonic acid gas more slowly than through air, were bent inward as they passed through the bag. By sending them through a concave bag filled with hydrogen, the opposite effect was achieved. The hydrogen speeded up the waves, bent them outward and scattered the sound.—R. A. Denver, Colo.

Small Prize Is Requested for Big Engineering Job

WHY doesn't some mechanical magazine offer a prize for the best solution of such problems as making electricity from wind power or harnessing the tides or using the pressure of the atmosphere? A thousand-dollar prize would interest many engineers. There is no problem that can not be solved, if you can find the right man for the job. A prize would speed discovery.—G. H. A., Roosevelt, L. I., N. Y.

You Might Try Being the Goat of This Problem

HERE is a problem that I think the mathematical sharks among your readers might enjoy tackling. A circular enclosure, having a diameter of forty feet, has a straight fence tangent to it. At the point of tangency, two goats are tethered on opposite sides of the point of tangency. One goat has a rope fifty-four feet long. How long must the rope of the other goat be so that their combined grazing area measures 3,112.2 square feet?—F. G. C., Myrtle Point, Ore.



Homeopathic Doctors Know Their Snake Poisons

REMARKING to the article published in a recent number of POPULAR SCIENCE MONTHLY under the title "Deadly Snake Poison Saves Human Lives," I would like to say that this statement as far as saving human lives is concerned is true. But the assumption that it is new is not true, and it is not quite fair to the public and the homeopathic medical profession to allow it to go unchallenged. I contend that the article is unfair for I cannot believe that any body of scientists or any school of medicine can be ignorant of the facts that snake poisons were developed and have been in use by the homeopathic medical profession for the past 130 years, and that they, as well as indications for their use, can be found in any Homeopathic Materia Medica. Snake farms have been in operation for many years to supply the venom to the homeopathic school of medicine.—(Dr.) J. S. V., Dayton, Ohio.

Will the Chemistry Sharks Please Tackle This One?

CHEMISTRY is my main interest. While experimenting in my home laboratory, I got a notion of making a candle with a blue flame. I began trying out all sorts of chemicals, and soon I had many solutions ready. I had mixed chromic acid with potassium nitrate, and then I thought of adding a little gasoline and alcohol to see what sort of flame would result. The moment I added a drop of alcohol, there was a burst of flame. By further experimenting, I found that a little alcohol poured upon chromic acid would produce fire. I brought this problem to a teacher of science who studied it and found it was entirely new to him. I later took it to the head chemist at the Grand Rapids Filtration Plant. He suggested that I write these facts to you and see if your readers could furnish an explanation.—E. G., Grand Rapids, Mich.



Western Horse Thief Keeps Himself Strictly Up-to-Date

ACCORDING to L. D. V. of Pittsburgh, Pa. in a recent issue of POPULAR SCIENCE MONTHLY, tear gas has replaced the cow boy's lasso in the modern cattle round up. That isn't the only thing that science has done to modernize the West. It has helped the horse thief as well. In Montana practitioners of the age-old profession of horse stealing now drive a high-powered truck, or to a fake-looking pasture use powerful portable lights to fascinate the animals, then stun them into submission and whisk them away silently on rubber-tired wheels. By morning the load is hundreds of miles away at some horse market. A rancher can depend on hoof prints to track down the cattle rustler but he doesn't have much luck following tire prints on concrete or even dirt highways.—J. K., Los Angeles, Calif.

Doubtless Coal's There Because They Need So Much of It

I'VE been puzzling over the discovery of coal in Antarctica. What I should like to know is why Antarctica, which by its coal deposits is proved to have once been warm and moist, should be covered by glaciers today while many districts showing evidence of long forgotten glaciers have a temperate climate? My own theory is that the explanation lies in the fact that the axis of the earth is shifting constantly and that the hypothet-

ical temperature changes have been nothing more than a shifting of the polar ice caps, due to this change in the angle of the earth's axis to the plane of its orbit. I wonder if I'm right?—P. A. E., Portland, Me.

Humanitarian Wants to See Bell-Ringing Cats and Dogs

HERE is a practical suggestion I should like to pass on to the inventive geniuses among your readers. Often I have seen cats and dogs trying to get into their homes. Mewing or whining does no good. These poor animals have to wait until some one opens the door. Why couldn't the animal be induced to sit down on a metal plate that had been placed near the door? Their weight on the plate would close a circuit and a bell or buzzer would sound inside the house and some one would then come and open the door and let the animal into the house. The plate could be placed where the animal usually rests while waiting for the door to be opened by an accommodating master.—H. S., New Rochelle, N. Y.



Variation In Speed of Light Due to Earth's Temperament

I WAS very much interested in the article on "Mysterious Variation in Speed of Light" in a recent issue of POPULAR SCIENCE MONTHLY. It is a well-known fact that the path of the earth around the sun is an ellipse, one focus of which is occupied by the sun. This causes the earth to travel faster as it nears and rounds the end of the ellipse nearer the sun than it does at the distant end of its orbit, thus giving the earth an annual variation in speed. It also has a speed variation due to its rotation with the moon about their common center of gravity. Our conception of speed in space is always relative. As we move with an object, its speed appears to diminish, while an opposite direction of motion on our part with respect to the object will convey to our senses an appearance of increased speed on the part of the object. Since the earth has been shown to have both an annual and a biweekly variation in its speed, they would cause any measurements on the speed of light, wherein the earth, or any point thereon was used as a datum point to show similar periodic variations, as was the case under discussion in the article mentioned above. Is my explanation satisfactory?—J. M. R. Louis Linda, Calif.

Tamper-proof Stickum for All Mail Is Requested

HERE is a subject I wish to call to the attention of our chemist friend, Raymond B. Wailes. I am sure that many of us have had the unfortunate experience of having our mail tampered with by some unscrupulous persons. Even those who have not suffered from this bitter experience would appreciate some means of insuring the safety and privacy of their mail so that they could be sure there would be no surreptitious opening of letters. I think Mr. Wailes might be able to produce a stickum, to take the place of ordinary mucilage, that when once applied could not be unstuck by either moisture or heat. Please ask him to get busy on this.—A. R. W., La Gloria, Cuba.



GEARSHIFTING ABOLISHED

BY REO—NOT MERELY MADE EASIER



● Many an automobile advertisement these days talks of "easier gearshifting."

This point would hardly be stressed if it were not acknowledged that gearshifting by hand is at best a bothersome task from which the motorist is entitled to relief.

The ultimate in relief, of course, would be to make it unnecessary to shift gears at all—take the gearshift lever out of the car.

That is precisely what Reo has done!

Gearshifting-by-hand is not merely made easier in the new Reo. It is **ABOLISHED!**

The **REO SELF-SHIFTER**—most important engineering advance since the self-starter—does automatically what drivers of other cars are still required to do manually!

Imagine how much **SAFER** Reo drivers are, with both hands free for steering—and with no danger of ending in dangerous places on account of some slight mistake in shifting!

Thousands of owners have declared they could never again be induced to go back to hand-shifting. Nor would you—once you experienced the really astonishing advantages of the **REO SELF-SHIFTER**.

Standard Reo passenger car prices are now as low as \$795 at factory, plus tax.

WRITE today for copy of our interesting booklet, **PROOF**, containing enthusiastic comments of Reo owners. Also detailed explanation of Self-Shifter operation.

See and drive the new Reo Flying Cloud for 1934—a brilliant triumph in aerodynamic streamlining and long life construction. Amazingly low prices.

REO MOTOR CAR CO.
LANSING, MICH.

Every Needed Fact, Figure, Formula Every Shortcut and Special Method in the **WHOLE FIELD** of **MATHEMATICS**

Now in ONE Handy Volume!



For the first time you can have this wealth of practical mathematical information, covering every trade and business, condensed into one handy book for quick reference. This volume puts right at your fingertips instant facts and formulas for making every kind of mathematical calculation. From hundreds of different sources, its priceless information has been gathered together, poured down into brief, simple and sure and **POWERFUL** to solve all problems. Every man in business, every man in the mechanical trades, every man who ever uses a tool or has to make calculations of estimates in office, shop or home, will find a treasury of money-making money-saving ideas.

THE HANDBOOK OF APPLIED MATHEMATICS

No previous knowledge of mathematics is needed. No study is required. The special formulae you want are easy to find, by looking it up in the index. The book gives you every rule and gives you starting methods easily applied, for solving every problem. Thousands of square examples show you just how to make your calculations. Let our work, even in mathematics in any way this complete reference handbook can aid you, probably save you your reputation. It is an amazing time-saver for any one connected with engineering, architecture, electrical mechanics, engineering, all specialties, machinery, printing or any other industry, work of all kinds, running and long manufacturing, costs, taxes or any other business made math. No practical man, no house, who makes calculations, what no one who has a home workshop can afford to be without the ultimate information quickly found in this book.

Simplified, Dependable Methods by an Expert

The author of this book, Mr. Max L. Janison, has had the widest experience in practical work. He has been an expert and has been in charge of all kinds of work, and he has had years of experience in running and long manufacturing. He has supervised adult classes at New York University. He gives you the benefit of his wide experience in this book.

EXAMINE THIS BOOK FREE

SEND NO MONEY—MAIL THIS COUPON

Last Call! Save 17½% on this Special

Advance of Publication Offer

The regular price of this book will be at least \$4.95. If you order now (any day) you may have it for only \$4.25. Easy payments of \$1.00 with \$1.25 down. **1 Over 600 Pages, 375 Illustrations, 144 Tables, Durable Mylon Fabricoid Binding.**

Save Time—Be Sure of Your Facts

One quick turn to the index and you find at once the best mathematical methods for solving your problems. You avoid the expensive errors that handicap the man who merely guesses. Think what an advantage it is to have all this information in one handy book.

See How Thoroughly It Covers the Needs of YOUR Work

Arithmetic (including Slide Rule)	Concrete or cement Carpentry	Machinist Shop Automotive Shop
Algebra	Carpentry Building	Sheet Metal Work
Geometry	Carpentry Lathing and Plastering	Electricity
Trigonometry	Painting	D.C. and A.C.
Weights and Measures	Pipefitting	Print Shop
Mechanics	Plumbing	Boilers
Estimating and Fundamentals	Roofing	Mathematics Accounting

D. VAN NOSTRAND CO.

250 Fourth Ave., New York

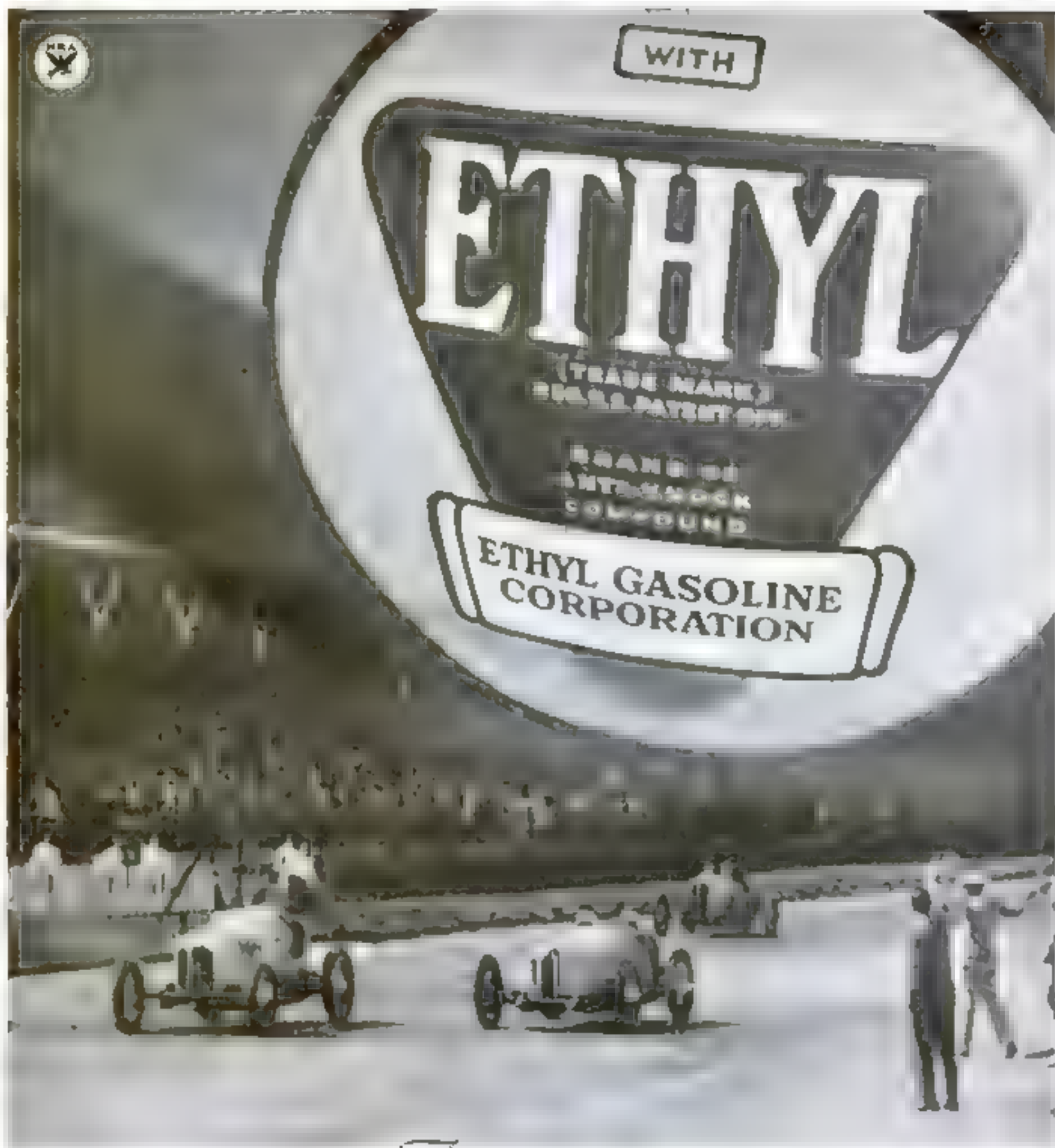
Send me *The Handbook of Applied Mathematics*, at the special price of \$4.25. I will pay \$1.00 with my order, and the balance of \$3.25 in four installments of \$0.81 each, due on the 1st of each month for 4 months. I will pay \$2.00 in full alternative for 2 months. \$4.25 in full. **NAME** _____

Address _____

City _____ **State** _____

Reference _____

Address _____



For the past 10 years, every car to win the 500-mile Memorial Day race at the Indianapolis Speedway has used Ethyl. Give your own car something of this same high compression performance. The price of Ethyl is now down to only 2¢ a gallon over regular. NEXT TIME GET ETHYL

ETHYL CONTAINS SUFFICIENT LEAD (TETRAETHYL) TO MAKE IT THE WORLD'S QUALITY MOTOR FUEL



POPULAR SCIENCE

MONTHLY

July 1934

Vol. 125, No. 1

RAYMOND J. BROWN, Editor



New Foods

FROM THE

Test Tube



and to produce it in quantities. During the search, he has made countless experiments and has journeyed half around the world. Now, more than 10,000 miles from the point at which he began, his quest has ended in success.

By adding fuller's earth, a claylike substance used in filtering oils, to an extract made from rice husks, he is able to isolate the vitamin B sub 1. The vitamin molecules are caught like flies, on sticky flypaper, and held by the earth particles in the solution. In fact, they adhere so tenaciously that the hardest problem of the research has been to dislodge them. Hundreds of attempts ended in failure. Finally a form of quinine was poured into the mixture. Its molecules immediately pushed the

vitamin particles off the soil grains and took their places, thus freeing them so they floated in the solution. After that it was an easy matter to concentrate and crystallize them.

To produce a single ounce of the concentrated vitamin the scientist has to use from five to ten tons of rice husks. Six years ago, two Dutch chemists, working in a European laboratory, isolated

By EDWIN TEALE

HOLDING a tiny mound of white crystals in the palm of his hand, a New York scientist recently came to the end of a twenty-year trail of investigation.

He is Robert R. Williams, head of the chemical research department of the Bell Telephone Laboratories, and the crystals he has produced are a concentrated food vitamin of amazing possibilities. When white rats, scurrying about cages in a Columbia University laboratory, sipped water in which the magic crystals had been dissolved, they made astonishing sports in growth. Applied to humans, it is suggested, the new food may increase the stature of undersized children or even, in the realm of the fantastic, produce giants!

Aside from these sensational possibilities, the concentrated vitamin has shown itself a potent nerve food, valuable in treating neuritis, neuralgia, and beriberi, the dread nerve and heart disease of the Orient.

Twenty years ago, in a bamboo hut in the Philippines, Williams saw a child, dying of beriberi, saved by a few drops of rice extract. The two decades that have followed have seen him struggling year after year in an effort to concentrate the life-saving vitamin that is found in rice husks

Above, Robert R. Williams who has recently succeeded in isolating vitamin B sub 1 which is expected to be of value in treating nervous disorders. Below, fumigating trays of fruits in large tanks under high pressure





Right, vitamin E concentrate is added to flour by the machine above. Above, a machine concentrates that in one vitamin E with the flour.

the vitamin B sub 1. But their method could produce no more than a few flakes of the precious substance. Williams' discovery, however, permits large-scale manufacture and may play an important role in producing new foods of the future.

This science has added another link to the long chain of its achievements in the realm of food.

New foods, improved foods, purer and more nourishing foods—these are the goals of a host of workers. This scientific fighting in the white uniform of the laboratory stands a constant guard over the nation's food supply. It has prepared improved containers and better methods of packing, new and ingenious tests for freshness and nutritive value, and it has given us such recent striking innovations as powdered soups that can be shaken from sprinkler-top cans, flaked coffee that can be percolated with cold water or brewed like tea, and plastic creams that have their fat molecules elongated by centrifugal force to enable them to pack more closely together.

We have learned much about food since that day in 1912 when the Polish chemist, Dr. Casimir Funk, coined the word vitamins for the mysterious, invisible elements in foods which are so potent in their effect upon health. Everyone now knows how vitamin A, found in greens, dairy products and fish oils, builds resistance to infections; how vitamin B, derived from fruits, yeast and lean meats, stimulates the appetite and is a tonic for the nerves; how vitamin C, plentiful in oranges and tomatoes, prevents scurvy; how vitamin D, from milk, butter, and cod-liver oil, prevents rickets; how vitamin E, found in molasses, lettuce, and wheat germs, prevents sterility; and how vitamin G, the anti-pellagra vitamin found in yeast and egg yolks, annually saves hundreds of lives in southern states.

One of the mysteries of science is how vitamins perform their life-preserving tasks within the body. Nobody has ever tasted, seen, heard, touched, or smelled a vitamin.



White rats are used to study how vitamins function in the body.

Recently vitamin C has been concentrated into a more effective form for fighting scurvy by the Norwegian scientist Dr. Ottar Rygh. By evaporating the juice of unripe oranges in a partial vacuum and treating it with chemicals, he produces a yellowish oil shot through with needlelike crystals. From these needles he produces his food-medicine. What has taken place not even Dr. Rygh knows, yet in a single step he has brought nature into his laboratory and helped pave the way for vitamin C to be made easily available for the world.

When the Byrd Expedition headed south for a long stay in the Antarctic, several cases of orange concentrate were carefully stored away among the provisions. In an emergency, the leader counts upon this material to prevent scurvy among his men. In tiny death chambers in the Los Angeles, Calif., laboratory of Dr. Roger W. Truesdale, white rats were recently gnawing at the wire netting that restrained them from freedom. They craved some-

thing lacking in their rich foods. Beside them were cages containing sleek and contented animals. What the first rats lacked was vitamin D, that mysterious element provided in the past chiefly by cod-liver oil.

Remarkable work by Americans in solving mysteries of diet and developing new agents of health is told in this article . . . Part played by vitamins is clearly described



Here an olive sample is being immersed in beef broth. If dangerous bacilli are present they will grow very rapidly.

thing lacking in their rich foods. Beside them were cages containing sleek and contented animals. What the first rats lacked was vitamin D, that mysterious element provided in the past chiefly by cod-liver oil.

Dr. Truesdale was demonstrating that a yellowish concentrate obtained from sardines and tuna is also a potent sunshine oil, that it is ready the stuff babies and the aged, as well as white rats, require when their bones ache and they lose their taste for good food. As a result of his experiments, special apparatus in one large California macaroni factory adds drops of the vitamin oil to the flour as it passes down the production line to the machine that turns it into macaroni.

One hundred gallons of fish oils yield only one ounce of the Truesdale concentrate. This is so powerful it cannot be taken in the pure form. When it is mixed with fourteen gallons of sesame or corn oil, it is still, tests have shown, sixty times as rich as the vitamin D content of standard cod-liver oil.

Incidentally, the discovery promises to prove a boon to American fishing. Previously the dark tuna meat was made into

poultry feed and only the white packed. Now oil from the dark meat and sardine oil, formerly used mainly as an ingredient of paints, become important health sources.

Another discovery about vitamin D has just been reported by the U. S. Department of Agriculture. The more sunshine a hen gets, the more vitamin D there is in its egg yolks! Fifteen minutes' irradiation with an ultra-violet lamp was found to have the same effect in increasing the vitamin content of the eggs as adding one percent cod-liver oil to the diet.

Heat and air are vitamin-killers. Not long ago, that brought up a curious problem in an eastern factory. Tomato juice canned in this plant was found to contain fewer vitamins than the juice put up by rival companies. All the companies used

on Vitamin Standardization is being held this month in London, England. Delegates will seek to work out units for measuring vitamins which will be adopted throughout the world.

The work in vitamins is only part of the activity of the food research battalions. Developing new foods and working out improvements in old ones form important phases of the research.

Take for instance, a new plastic cream recently placed upon the market. It is produced, oddly enough as the direct consequence of defying an apparent physical law. The fat concentration limit in an emulsion is, due to the globular form of the fat particles, about seventy-four percent. Why not change the shape of the particles so more would fit in a given space? That was the question one research worker asked himself. Harnessing terrific centrifugal force, he elongates the particles, packs them closer together, and accomplishes the apparently impossible. Creation of this new kind of cream has made possible a variety of new spreads through the addition to

them of honey, fruits, and various flavors.

Milk that won't curdle is another gift of the laboratories. It is of especial value in feeding babies. The process, recently perfected, filters the milk through zeolites, one of the family of silicates used in making glass, thus removing the calcium which is responsible for the curdling. Additional vitamins, introduced into the milk, increase its value.

To enable infants and invalids to digest thick vegetable purees, laboratory men have just worked out a new method of pressure cooking. It breaks down the starch cells in the soups thus making them easier to digest.

Flaked coffee, that can be brewed like tea or percolated for icing with cold water has proved a success in the laboratory and is expected on the market soon. Gases generated within the coffee bean during roasting were found to escape and carry away much of the aroma when ordinary roasting and grinding methods were used. By rolling the coffee into leaves as soon as it is ground, the scientists find they can squeeze out ninety percent of the gases without loss of aroma. After a lapse of two years, leaves packed in containers filled with carbon dioxide gas, to exclude all air, were found to be perfectly fresh.

Vacuum packing excluding all oxygen, is an advance that has been widely adopted by American manufacturers. An oxygen detector, which is placed in such cans, is the latest innovation in the field. It is a slip of paper treated with chemicals so it will change color if any air finds its way into the container. Thus the purchaser is able to check up on the freshness of the goods he buys.

A few years ago, midwestern canning companies were flooded with complaints about sweet corn that came out of the can spotted with black. Investigation revealed that minute quantities of sulphur (Continued on page 112)



After dunes have been fumigated for the purpose of killing the injurious bacteria, they are run through these troughs and sorted

Below, spinach that has been passed through the drying bins and dehydrated is returned to this bin and weighed before being packed



The chemist's work on fruit is started early and photo below shows orange trees being fumigated to stop a serious blight

the same kind of tomatoes. The vitamins were in the tomatoes. Somewhere between the farm and the can part of them disappeared. Where? An industrial chemist tackled the riddle. He found that the machinery beating up the tomatoes drove air into the juice, oxidizing and destroying the sensitive vitamins. A simple change in the apparatus overcame the trouble.

That vitamin B, in addition to its accepted value as a nerve conditioner and appetite builder, has a mysterious effect upon the intelligence has just been discussed by tests in one American university. Rats deprived of this vitamin had twice the trouble extricating themselves from mazes as those whose diet contained it. Whether it will also prove a gray-matter vitamin with humans, scientists are not yet prepared to say.

Because different sizes of animals and different methods are used in research laboratories in determining the vitamin content of foods, an International Conference



Thousand-Mile

PROTECTS GREATEST



On a slender ladder high in the air, adjustments on power line insulators are made as at the left by a structural worker at a switching station.

CARRYING the heaviest electrical current ever conducted by a commercial power line, the longest and most efficient transmission system in the world will soon be in operation between Boulder Dam on the Colorado River and Los Angeles, Calif.

Protected from the damaging fury of lightning and storm by every means modern science can devise, the hollow copper cables of new design will cross 20 miles of desert mountain and plain to bring Los Angeles an uninterrupted 275,000-volt current sufficient to light 50,000,000 ordinary fifty-watt lamps.

Transmission of this tremendous burden of current over a distance as great as that between Chicago and St. Louis offered difficult engineering problems. Corona loss, the leakage into the air of electrical energy, was one of these. The necessity for adequate protection against lightning was another, and even more important problem, since lightning will be an ever-present menace. The cables, it is estimated, will be subject to shocks as great as 10,000,000 volts. To minimize the danger, a lightning "rod" 1,000 miles long will guard the line.

This length is necessary to protect the double line of towers that form the system now being constructed by the Los Angeles Bureau of Water and Power. Two files of towers, rearing themselves like spectres above the desert brush and cacti, carry the six cables for the first 230 miles. At a point near San Bernardino, the files converge and the cables are borne the remaining forty miles into Los Angeles on one line of double towers.

The lightning rod designed to safeguard these 2,800 towers and 1,620 miles of cable is not a rod at all.

It is an elaborate system of wiring so constructed as to control the enormous voltage of a lightning shock.

Ordinarily, lightning, striking a tower, would race down the framework and be turned back by the comparatively restricted ground area at the base of the tower. Then the current, rolling back up the tower, might form an arc across the insulators, and disable the line for long periods.

The newly designed rod, intended to prevent such damage, consists of one

In laying the 1,000-mile underground lightning rod, a three-foot ditch is dug by a double plow, drawn by two tractors, as illustrated above. The plow lays the wire and fills in trench as it moves forward.

Right, motor buffer assembly that was used to scratch the cables clean at the same time they were being tested for leakage of current.



Below close-up view of heaviest and one-quarter helicopter cable used in world's greatest power line. Note the manner in which the pieces are fitted together by means of tongues and grooves. Right, illustration shows the exterior of the cable.



Lightning Rod

POWER LINE

galvanized wire stretching along the tops of the towers 150 feet above the ground and a black copper wire buried three feet in the ground in contact with the towers. Where the power line is carried by two lines of towers, the underground wires are connected every 1,000 feet.

Lightning striking the elevated wire, will be conducted down the tower and by means of the subterranean network, it will be distributed over a wide area of the earth. The system will instantly dissipate 13,000,000 volts of a 16,000,000-volt charge, the maximum voltage to which, with rare exceptions, the line will be subjected. The insulators and conductors are designed to withstand the remaining 3,000,000 volts. If, exceptionally, shocks run as high as 19,000,000 volts, it is expected that small sections of the line will be temporarily disabled but that no serious damage will result.

Next among the problems presented by a transmission line of this length was that of corona, or leakage of energy which is similar to the radiation of heat from a steam-power line. This loss would be sufficient, in a line as long as this, to supply current for a city of 30,000 population.

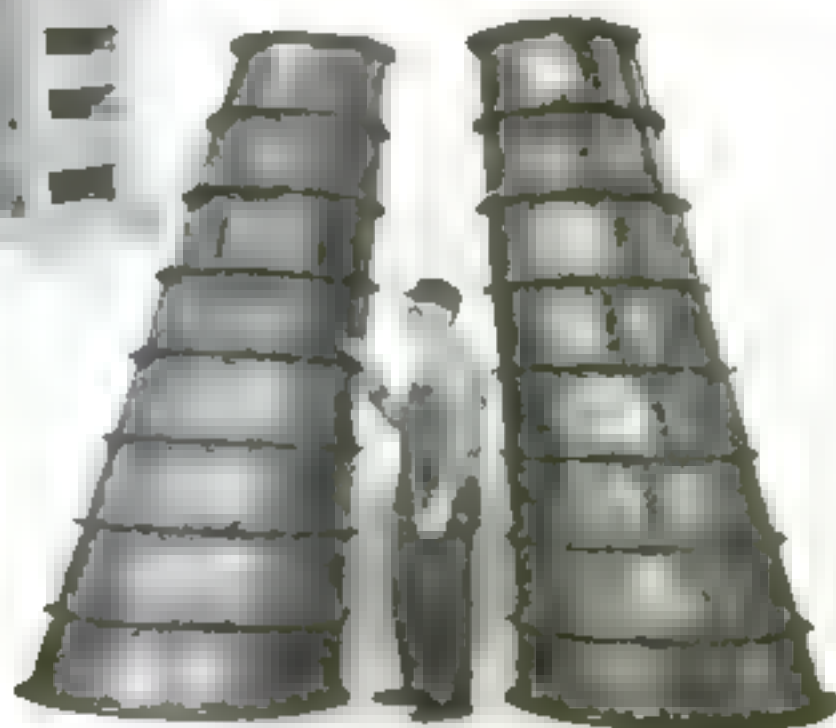
An obvious remedy was the use of a cable of larger diameter since corona occurs only when high voltages are forced over a wire of inadequate section. Increasing the cable diameter, however, meant such an increase in weight that stronger and more expensive towers would be required.

Hollow cable solved the problem. The cable adopted is one and four tenths inches in diameter and is built up of ten copper strips, tongued and grooved and joined. *(Continued on page 111)*

Right: a pulling device used to test the concrete anchors that support the big cable towers of the power line. Each anchor was tested in this manner after it was in place.

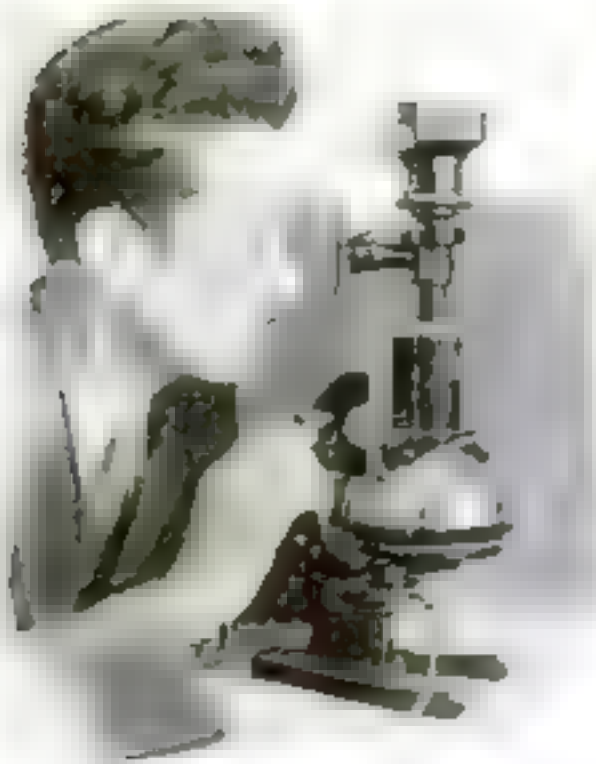


Above: a view of one of the great towers that support the cables that carry power for 270 miles across a California desert. The size of the tower can be judged from the automobile standing near it.



Above: two of the steel forms, eight feet tall that are used to hold the concrete footing blocks until they hardened so the forms can be removed. At left, a night view of cables during test for current leakage. Note how corona has illuminated the wires.





Microscopic study of opaque objects is made easy with a new attachment that is said to fit any standard microscope. An electric bulb of special design is used in place of the mirror-condenser system and light from this bulb is directed downward



Left: new illuminator that attaches to microscope and lights an opaque object for study or for the camera. Above: print photographed with illuminator enlarged about twelve times

NEW MICROSCOPE LIGHT FOR OPAQUE SPECIMENS

upon the specimen by a concave reflector that rests on the edge of the stage. By means of an annular ring it is possible to block off nearly seven eighths of the light so that illumination can be made to fall from any direction. In this way slight irregularities in the surface are made visible and a true view of the object obtained.

HOW FOREST RANGERS TRAIL FIRE BUGS



U. S. Forest Rangers sometimes turn detectives to track persons suspected of starting fires, as the photograph at the left shows. It illustrates a ranger sifting prepared materials, together with water from a handy canteen, into a suspicious footprint in order to make a plaster cast. Where the imprint is too indistinct for this treatment, measurements are taken with a ruler. The revealing evidence offers a distinct aid in tracking down the suspect, since it may prove that his shoes fit the prints.

JAPAN'S MYSTERY SUB MANNED BY TWO MEN

Its purpose shrouded in mystery, a midget submarine manned by only two men was recently tested in Japan before Army officials. Even the reproduction of the photograph shown below was banned in that country. According to one report the submarine is designed for use in shallow rivers and lakes. It is also rumored that Japan plans torpedoes which would be piloted toward enemy ships by volunteers willing to sacrifice their lives in the resulting explosion.



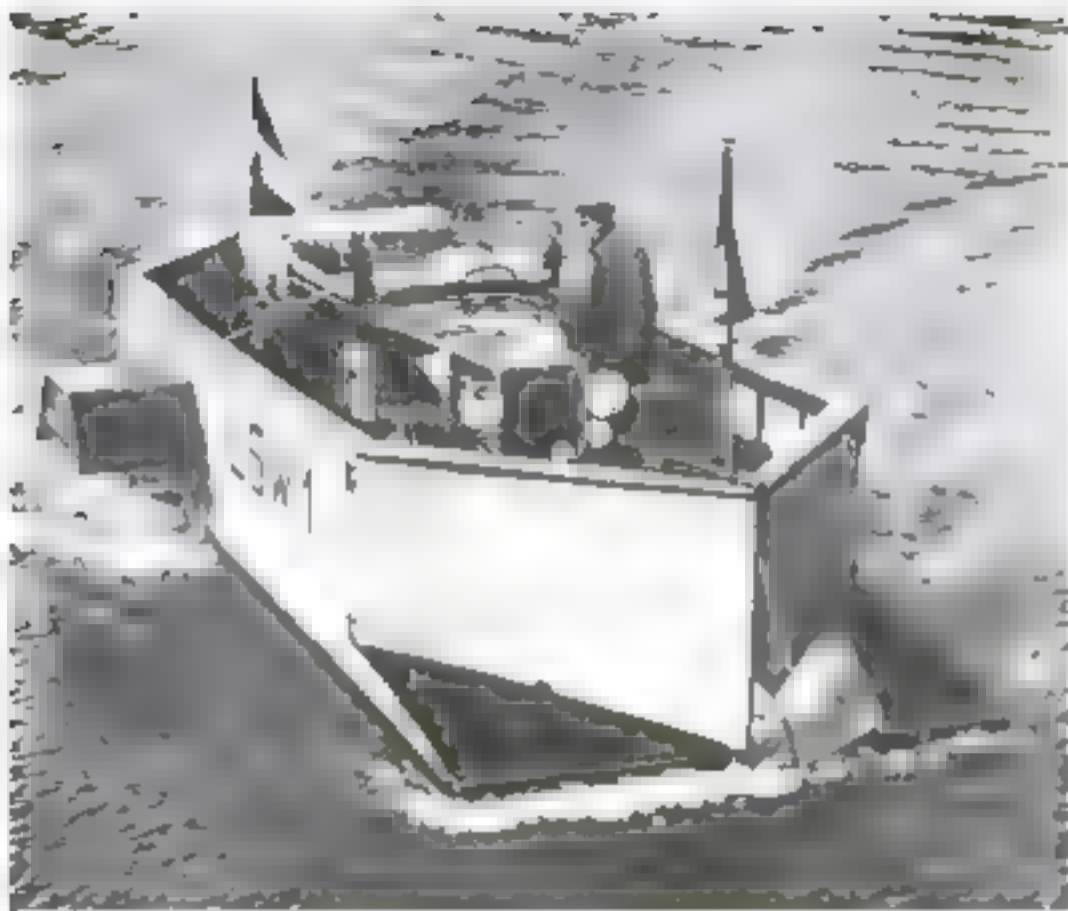
CAMERA PROVES LOCH NESS SEA SERPENT IS JUST A WHALE

BY IDENTIFYING the sea serpent of Loch Ness, Scotland, as a familiar species of whale, naturalists have just shown how easily the human eye may be fooled into thinking it sees an unfamiliar monster. Worldwide interest was drawn to Loch Ness, within recent months, by repeated eyewitness reports of a long-necked, aquatic apparition of huge size, resembling no known marine animal. Finally Dr. Robert K. Wilson, noted British surgeon, managed to get a snapshot of the elusive creature, and the mystery vanished. The picture shows the curved fin of a killer whale protruding in the lake from the water strongly suggesting an elongated head. According to Dr. Roy Chapman Andrews, noted explorer and zoologist, and others who agreed on this identification, the whale evidently had strayed up an inlet from the lake. This was the second sighting cleared up recently. Examined by a committee, the creature, washed up dead on Forvie beach, (P. S. M., May '34, p. 38) to which the species made almost unrec-



Left: the Loch Ness monster, as seen by a camera. Right: the same creature, as seen by the human eye.





PASSENGER'S CAR POWERS FERRY

Power for a new motor ferry, recently tried out on the Amersee River in Bavaria is supplied by the passenger's car. Driving onto the open deck of the ferry, the motorist stops with the rear wheels of his car resting upon rollers, similar to those used on most brake-testing machines.

The car wheels, driven by the motor, are then used to turn the rollers, which are geared to the paddle wheels on each side of the ferry. Thus the auto's engine propels the one-car boat.

USE EXTENSION LADDERS IN WORK ON BIG AIRSHIP

GIANT extension ladders, each as tall as a five-story building, help keep the airship *Macon* in good order. By climbing to the top, repair men may reach a point halfway up the side of the craft in order to inspect the fabric and exterior control fittings. The striking view reproduced below shows two workmen saluting each other from their lofty perches.



NEW SAILBOAT HAS SPINNING CONE IN PLACE OF SAILS

Using a three-vaned spinning cone instead of the usual canvas sails, a new sailboat has just been developed with which the inventor hopes to steer almost directly into the wind. The vanes, which on full sized boats will be of light wood and fabric construction, will be reversible according to the direction of the wind, reducing the necessity for tacking and avoiding the keeling over common to conventional sailing craft. According to the inventor, his sails will develop three times as much propelling force as those of canvas.

Inventor exhibits a model of his new sailboat that



INDIVIDUAL STANDS FOR PICNIC DISHES

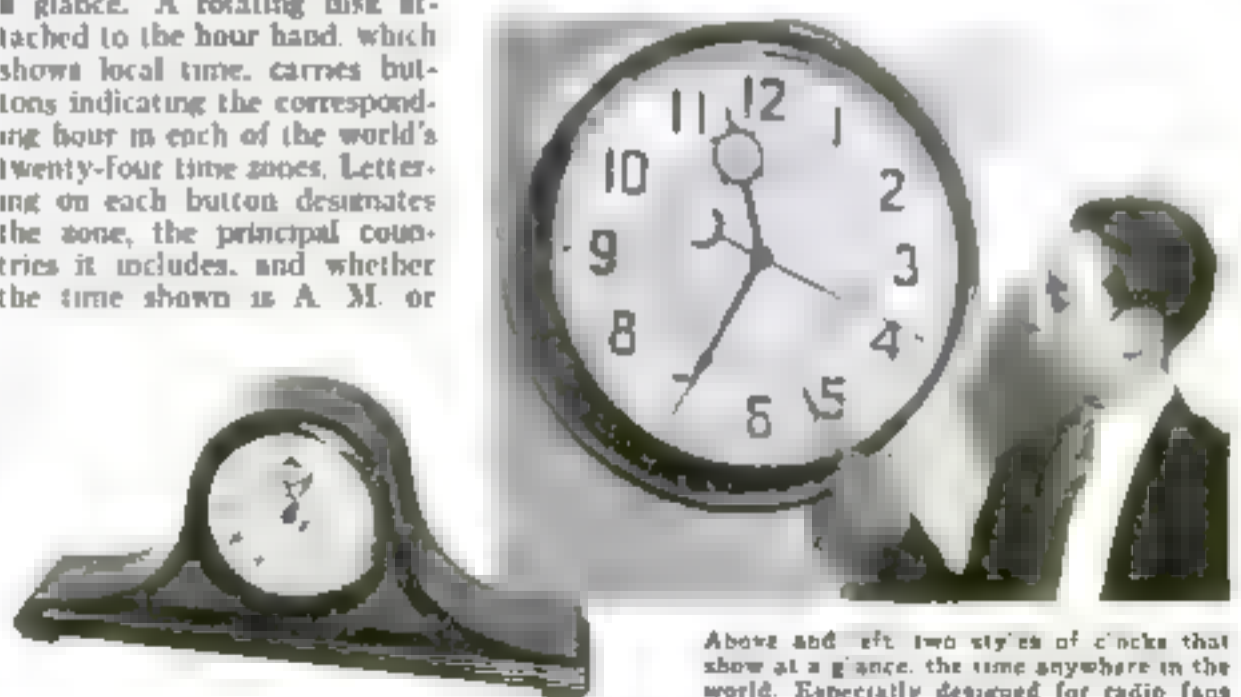
Individual stands for cups and plates are expected to add to the comfort and cleanliness of outdoor meals. A spike with supporting brackets, on which a common paper plate is impaled, provides the base of the stand and is thrust in the ground, after which a cup holder is clamped on top of the plate. Food and drink are thus kept handy without danger of spilling, and remain out of reach of ground-crawling insects, as shown at left.




CLOCK TELLS TIME ANY PLACE ON EARTH

SUPPLANTING the use of complicated time charts, a new clock dial, designed especially for short-wave radio fans, tells the time all over the world at a glance. A rotating disk attached to the hour hand, which shows local time, carries buttons indicating the corresponding hour in each of the world's twenty-four time zones. Lettering on each button designates the zone, the principal countries it includes, and whether the time shown is A. M. or

P. M. To enable this information to be read at any point on the dial the buttons are pivoted so they remain upright.



Above and left two styles of clocks that show at a glance the time anywhere in the world. Especially designed for radio fans



Wind gage on top of Mount Washington. Vt. Electric heat keeps it free of ice. It recorded a 231-mile wind.



MOUNT WASHINGTON GALE SETS RECORD WITH 231-MILE SPEED

FROM the isolated summit of Mount Washington, Vermont, where an unprecedented wind velocity of 231 miles an hour was recorded a few weeks ago, have just come the first photographs of the men who made the observation and of the lonely observatory in which they recently ended their winter vigil. Although meteorologists have known that winds attain almost incredible velocities, the record made by the anemometer at Mount Washington was the highest ever measured accurately. Anemom-

eters maintained by other mountain-peak observatories in the country are not thought to be sufficiently sturdy to withstand winds of this intensity. The 231-mile-an-hour wind at Mount Washington blew for only a few seconds but long enough to leave its record. The men are isolated from the world during the winter.



At top, scientist studying sky from the roof of Mount Washington observatory. Above, observatory's tail room.

ELECTRIC FAN HELPS BOXERS GET BREATH BETWEEN THE ROUNDS

AN electric fan was used to refresh boxers between rounds at a recent military boxing tournament in Langkang, as shown below. The fan, its blades guarded by wire mesh, is hinged to the end of an extension arm attached to a corner post of the boxing ring. When the boxer resumes fighting, the fan is swung back outside of the ropes.



MORNING NOT BEST WORK TIME

CONTRARY to long established belief, the ability of most persons to work more swiftly and accurately on rising from a night's sleep is not as great as it may be at other times. This was one of the many surprising facts discovered during a new series of sleep tests conducted by Dr. Nathaniel Kleitman of the University of Chicago. In his experiments he used the electrical recording instruments shown above. With them, he charted the effects upon sleepers of alcohol and drugs.



Giant Generator Smashes Atoms

FANTASTIC in design as any motion picture creation, a 1,300,000-volt electrical generator is wrecking atoms of matter for scientists of the Carnegie Institution at Washington, D. C. Whirling, endless belts of silk pile up electric charges within a hollow six-foot chamber of aluminum atop this machine. By applying the tremendous voltage to a vertical vacuum tube of curious multi-sectional design, the experimenters have succeeded in smashing atoms of the elements lithium and boron. Transmutation of one element into another, and the harnessing of the energy believed to lie within the atom, are seen as possible results of such tests, which soon will be aided by a 10,000,000-volt generator recently completed by the Massachusetts Institute of Technology. "Photographs" of atoms recently produced by Prof. Arthur Compton, noted physicist, meanwhile give scientists and laymen their first concrete picture of what these fundamental units of matter look like. No man can ever hope to view an atom directly, since its size is far

smaller than even the smallest wave length of visible light, but its size and shape may be deduced from the pattern or shadow produced on a photographic plate when X-rays pass through an aggregate of atoms. From such X-rays shadows Prof. Compton mathematically reconstructed models of the atoms of helium, neon, and argon and rotated these before a real lens camera. The resulting pictures show the atoms as white fuzzy balls. Despite the circuitous process by which they were made the views are considered legitimate pictures of the atom's exterior, magnified about 200,000,000 times.



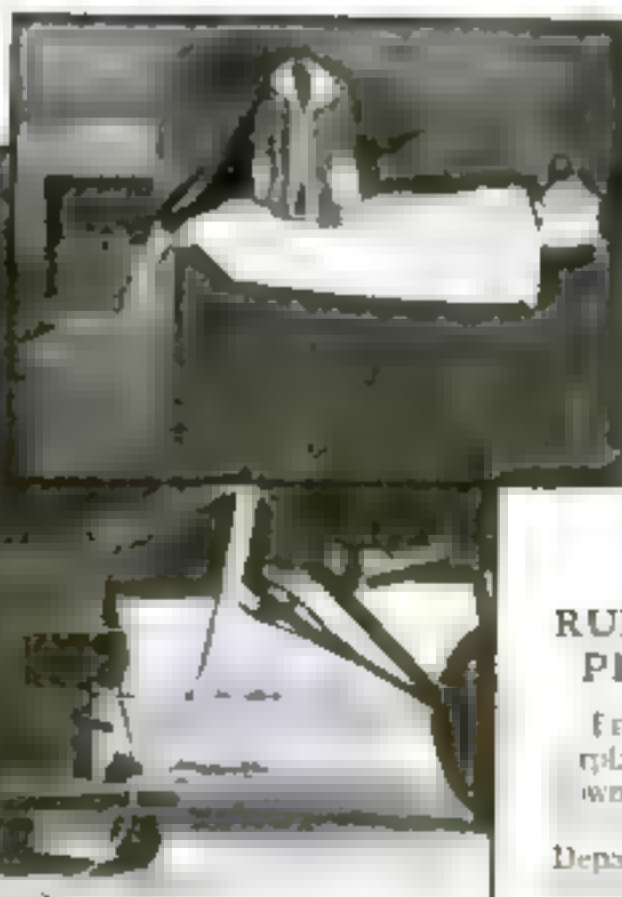
Left: the room below the generator into which the unusual vacuum tube extends



Above: new 1,300,000-volt generator with which lithium and boron atoms were smashed in the vertical tube extending beneath it. Left: first photographs to show argon and neon atoms. The atoms are magnified about 200,000,000 times

AIR NOW COOLED OR HEATED FOR PLANE AT AIRPORT

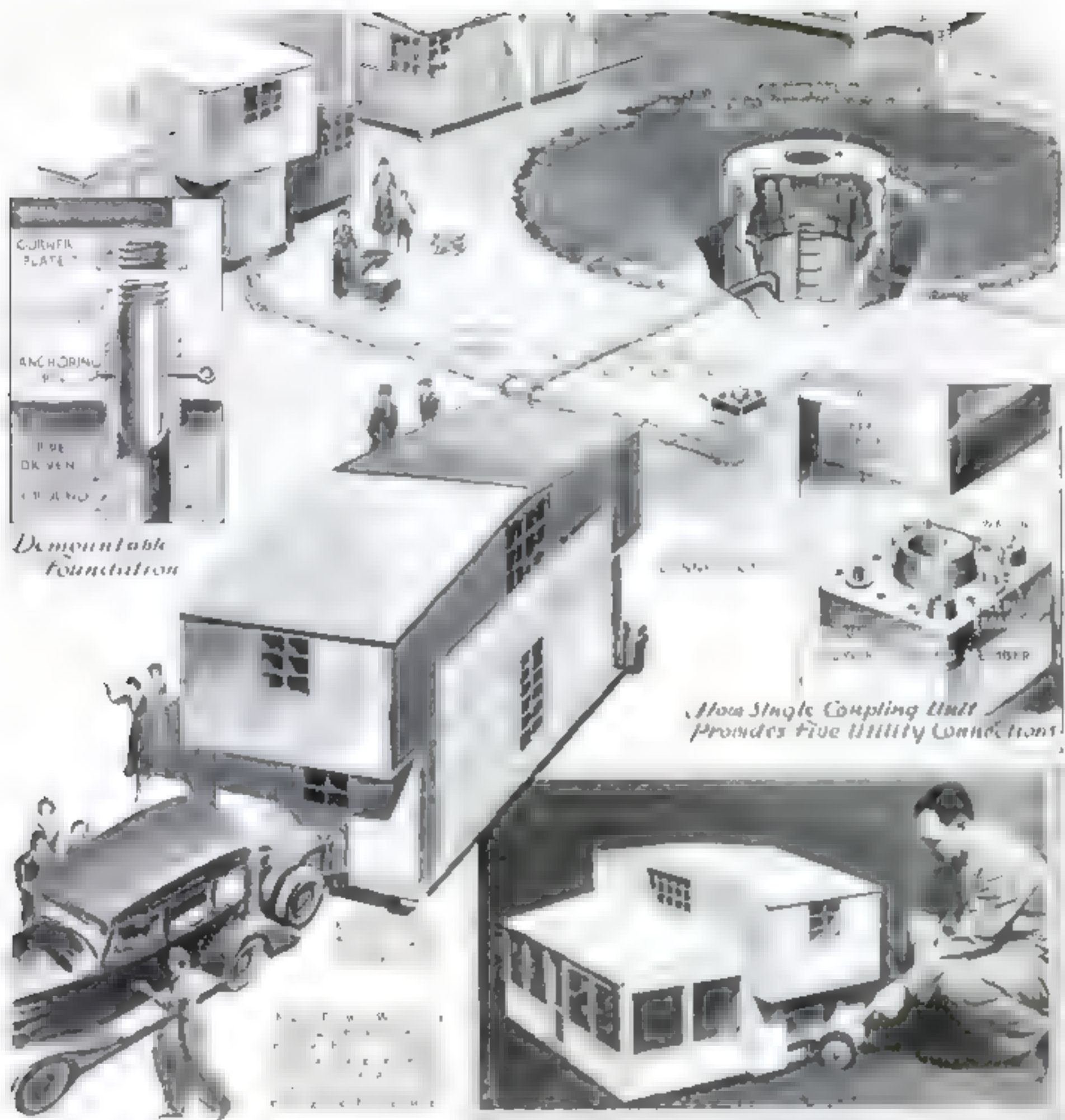
Ref. W. A. T. ...
K. L. ...



As in the confined quarters of a sleeper plane, which tends to become stuffy and either too hot or too cold when the plane is on the ground, is now, by means of a mobile conditioning unit kept as comfortable and healthful as when the plane is in flight. Some time before the take-off, the unit is placed under the fuselage and its flexible hose connected with the ventilating ducts built into the plane. The air, which is cooled or heated according to the weather is distributed within the plane to each berth. In flight, ventilation is supplied by the plane's built-in system but on landing and until passengers leave the plane, the conditioning unit is put in service.

RULE PERMITS DEAF TO HIRE PILOTS FOR STUNT FLIGHTS

Those whose physicians have advised acrobatic airplane flights as a cure for deafness may now be on for hire by commercial pilots, according to a ruling of the Aeronautics Branch of the Department of Commerce. Such flights will be permitted on the recommendation of a physician.



House on Wheels Towed by Auto

A NEW mobile house, just invented, can be towed over the highways on detachable wheels to any site chosen by the owner. As delivered to the purchaser, the dwelling in outside dimensions, would be smaller than many motor trucks now in use, according to Corwin Willson, housing research specialist of Flint, Mich., the inventor. The mobile unit would comprise a kitchen, bathroom, heating plant, two bed rooms and living room, and in it would be packed the unerected sectional walls, floors, and roofs of additional rooms. On the selected site, three sets of wheels

would be detached and the house set upon a demountable foundation. Erection of the sections would provide a large extra room on one side of the mobile unit and on the other a screened porch. The porch, if desired, could be enclosed and divided into two bedrooms. Gas, electric, water, and sewer lines would be attached by means of a special coupling device built into the house. Walls would be insulated against heat and cold so that the house would require less fuel than the usual dwelling of like size. Floor area would be saved by built-in furniture. Houses could

be built in this manner, the inventor estimates, for \$400. The owner, since the house would not be fixed to the land, would not have to buy a site. The inventor foresees the establishment of parking spaces on which such houses would be accommodated in groups of six. Here would be provided the necessary utility connections. For the privilege of parking the owner would pay a small ground rent. If this charge became excessive, he could hitch a car to his house and tow it to a cheaper site. This house moving would be a comparatively inexpensive process.

By
FRED FRAME

Famous Racing Driver



A street demon checks in at timing station on Motor Dry Lake before starting a run in the course of which he purchased a life. Centrifugal force had thrown him for a mile.

Dare-Devil Tricks OF RACERS MAKE YOUR Driving Safer

A REVEL of automobile road racing in recent months has proved that the average car seen on the streets today betters in speed and endurance the racing car of a few years back.

The press of traffic has driven the road race from the public highway to private courses. Yet in hazards and problems requiring utmost driving skill the new type

of road race far surpasses the old races.

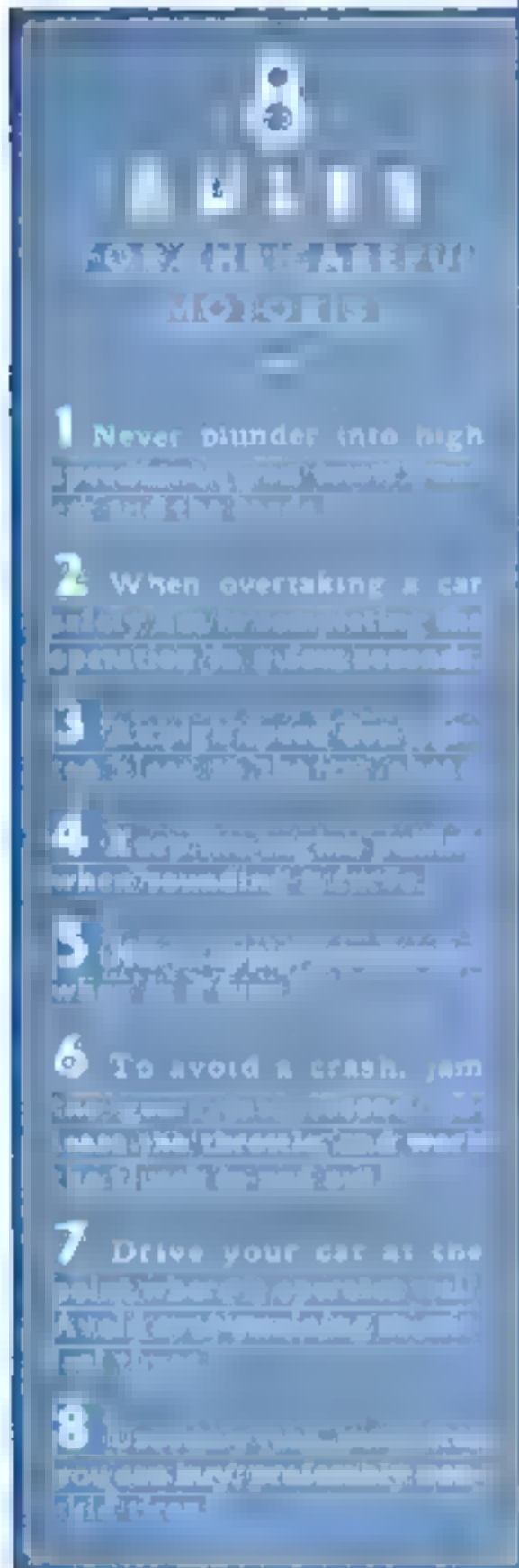
Last year witnessed the death of old-fashioned road racing when I won the 203-mile event at Elgin, Ill., in a Ford V-8 roadster with an average speed of eighty and twenty-two one-hundredths miles an hour. At times my car rolled faster than 100 miles an hour.

Contrast this performance with Ralph DePalma's record of seventy-nine and five-tenths miles an hour in his \$15,000 Balot racer over the same course in 1920 and you get the picture of automotive advance during the last fourteen years.

Now we drive at full speed on closed dirt tracks so hot around sharp turns, and bounce high when we strike holes due to skidding tires during early laps. The newest track at Inglewood, Calif., takes the form of a giant "B" measuring nearly two miles in length. Except for one half-mile straightaway the cars race in a series of turns that put them to greater strain than do the longer stretches of the open road.

I have learned many tricks of driving in races, but I find they are the same as those every good driver racing or touring applies to speedster or sedan.

As a racing driver I am presumed to be a dare-devil. True, I drive sometimes 160 miles an hour in



Here is the new type of track built for the road races. It is so situated around an airport so it is easily accessible and capable of accommodating a large number of spectators. Note ground outside the course is plowed up to prevent serious injuries if a car leaves the track.

Grueling Tests in Road Races Prove Average Car of Today Surpasses the Racing Car of Twelve Years Ago



Re	W	h	h	h
F	a	u	a	e
S	a	e	e	e
A	C	T	A	S

racing cars and more than 100 in stock cars, but, as racing drivers go, I am over-cautious. In fact to be over-cautious is the best suggestion I can offer any motorist. Drivers should never blunder into high speeds until they know not only their cars, but the roads on which they are attempting to make time.

Principles of sound driving apply equally to the tourist and to the racing driver. (Odd as it may seem, I often use my horn during road races. When ready to pass a car ahead, I put up as close to his tail as is reasonable at the speed we're traveling, jam down the throttle, give him the horn and pull around him as quickly as possible. I pass closer to his wheels than is good practice on the highway, but we are accustomed to driving in tight places. Sometimes our hubs are separated by no more than ten inches but safety lies in completing the operation in a few seconds, not loitering along slowly.)

Steering at high speeds is one of the fine points every driver should learn. Over-controlling, as the aviator expresses it, brings grief to many motorists. They sometimes forget that to move over two feet while traveling fifty miles an hour requires only the slightest turn of the wheel.

While you should never linger in passing the car ahead, there are serious dangers in running too close at high speed. If you are too close, you cannot see the road ahead and may pull out only to smash into an oncoming vehicle. Also, I have found in racing that a slower car actually can outrun the leader. This may sound absurd but it is true, and for very good physical reasons. The leading car breaks the air resistance, creates a partial vacuum, and actually sucks the second car along in its wake.



A thrilling moment in a road race comes when one driver cuts into another on a curve.

In racing, I have found I can stay with a car ordinarily ten miles an hour faster than mine by putting on a quicky behind as it flashes by and taking a tow to the next turn. Surprisingly, I find it necessary to close the throttle partially to avoid running into the packmaker. In lack of experience lies the danger of trying this stunt on your neighbor's big car when next you take to the open road.

Passenger cars attain speeds that were undreamed of when the old road races were run at Elgin in 1920. High speed may be a curse one day, a blessing the next. It depends upon the type of accident. I witnessed two, one of which resulted in a death while in the other high

velocity saved the car from accident and the driver from possible injury.

I left the pits in practice at Indianapolis one day, and as I pulled out toward the track Gene Marcenac, my mechanic, saw two cars approaching. He motioned me in, and I drove slowly along the apron until they could pass.

The leading car sped by, dashed into the turn and quickly straightened out on the backstretch. As the second driver started into the turn his car began to turn around. It slid sideways, his feet leaped into the back wall in front of us, climbed up on top of the parapet, fell off, he was dashed diagonally across the track to the outside wall, which he leaped and disap-

Right, driver in the rear is keeping so close to the speeding car ahead that the vacuum it creates pulls him along. Note, how the dust clings to the rear of the front car. In oval a car going ninety miles an hour skids into a rut and turned over. A tourist's car skidding into a curb might do the same.



peared among the trees after a twenty-foot drop. The driver tried to take the turn too fast and met disaster.

Some months later Harry Harts and I went to Murco Dry Lake in Southern California for a series of speed tests. No race course in the world surpasses a hard and dry lake bed for speed possibilities. It offers the finest proving grounds for new tires, for reasons which you will shortly see.

There had been laid out on the lake a giant circle, measuring ten miles in circumference. On it I was fortunate to establish nine world's speed records from ten miles to fifty miles, ranging between 147 and 144 miles an hour for these and intermediate distances.

At those speeds, as I noted by looking out at my left front tire, the tires are pinched in at the sides, building up the center so they run on a tread only an inch wide. Tires, originally six inches wide, will under conditions of such terrific centrifugal force measure no more than four. Even on the smooth lake bed when I hit loose surface the car would slide, sometimes swinging out a foot or more from its straight path. Only a foot? Try straightening your car a foot when whizzing along 160 miles an hour!

In one test, Harts felt one of his tires hit something solid. The car lurched but not daring to stop too suddenly, Harry drove straight ahead, easing the throttle slowly. He ran a full mile before his speed had slackened to forty miles an hour. He then found it more difficult to control his car than when running 100 miles an hour,

for centrifugal force had been holding the tire up.

Later, when we investigated, we found he had cut the tire on a fragment of a steel bomb exploded there some months before by a motion picture company. Yet such was the outward pressure on the tire as it sped around, we could not find marks of the broadening tread short of a mile from the place of impact. It does not always pay to slow down too quickly.

It is true, I drive the straightaways much faster than you drive the family sedan down a country road, but our methods should be the same. My terrific speed down long stretches and quick slow-down before going into turns look risky. But behind these maneuvers are careful thought and adequate practice.

Note that the rear wheels of this car are in the air as it bounces around a curve. The driver is cramping the front wheels to prevent a turnover.



When I entered the Egin race last year I decided not to race the other cars, but to attempt to beat what I thought would be the fastest probable time. Several days before the event I began to lumber up my roadster around the eight and one-half mile course. Down the high-crown macadam road, around a hair-pin turn, along the gravel lane, whizzing down the concrete straightaway, and again on a short dirt stretch I tried all combinations of skids and speeds. Soon I discovered I could run faster on the longer stretches by taking the turns slower, thirty-five miles an hour instead of forty-five. After all, the straightaway speeds count, for we're only on the turns a fraction of the total time.

"We'll make haste slowly" I said to my mechanic on the day of the race. He watched the speedometer and his watch, while I looked out ahead. I had been clocked along a mile stretch at 100.3 miles an hour. I knew one car was capable of 100.4 miles. Small difference, you say. In 20.3 miles, the distance to be run, that meant, all other things being equal, that driver would lead me across the finish line at least one fifth of a mile. Meantime I had decided to slow down on the turns.

But I had taken two other precautions. I picked out several landmarks, such as rural mail boxes near the turns and practiced shifting. (Continued on page 108)

Robot Guards Foil Uprising in Biggest Jail

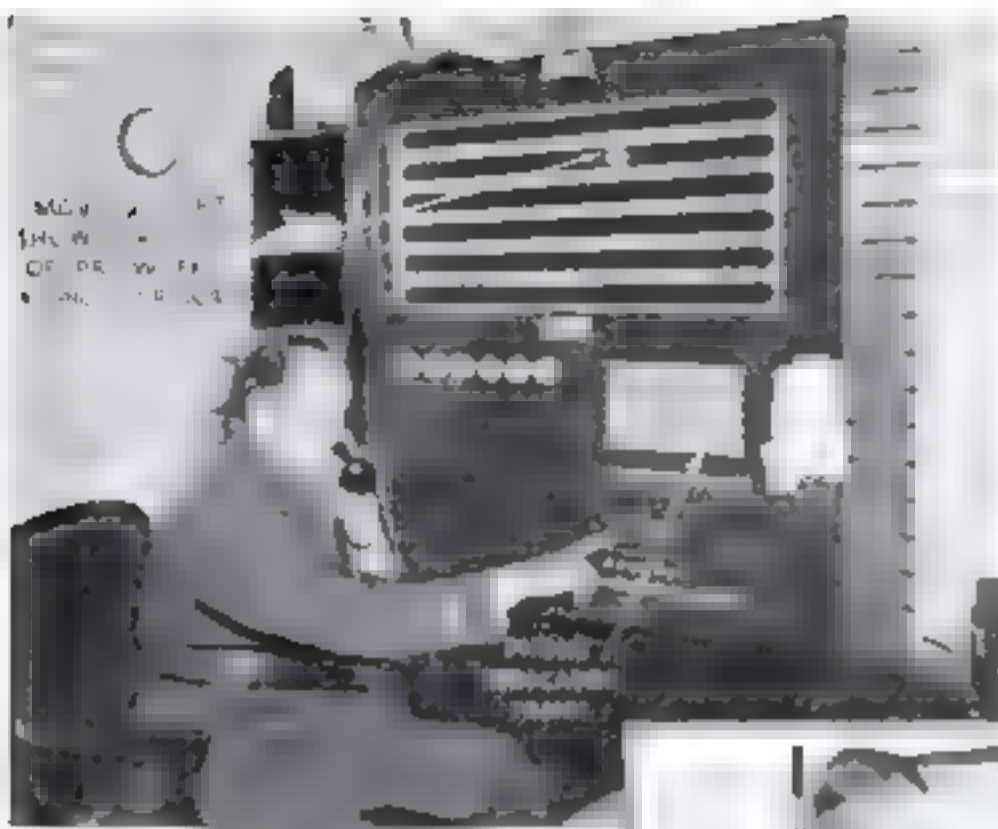


Illustration showing how the robot system would work in case of an attempted jail break

WITH one foiled jail break to its credit a new electrical communication and alarm system installed recently in the five-story county jail at Los Angeles, Calif., is believed to make the institution proof against an uprising of prisoners or an assault by armed gangsters from without.

This ultra-modern skyscraper jail, called the largest in the country, occupies the top of a tall building whose lower floors are used as courtrooms. A prisoner attempting escape has the choice of a sheer drop of ten stories, or a desperate dash for freedom through the corridors and elevators. To make the chance of success by either means even more remote, Clem Peoples, chief jailer, invented and installed the jail's remarkable electrical system.

Through its operation, secret signals from colored lights and buzzers aid jailers in their watch, sliding cell doors are operated through remote control so that guards need not expose themselves to attack, and even the elevators can be stopped instantly in an emergency.

Heart of the whole robot patrol system is a central control panel. Through it, an operator may get in touch with any officer in the jail by means of a buzzer system. Each officer has an individual code signal, and when it is sounded by buzzers installed throughout the building he steps to the nearest phone and reports. At night the buzzers are stilled and green lights, installed in pairs with red ones, are used for signals. In case of emergency, the central operator flashes on the red lamps through-

ing every available guard rushing to a telephone for instructions. This alarm was sounded recently when five prisoners were seen in a daring attempt to overpower a turnkey escape from a window with a rope improvised from her hair. Acting on telephone orders, guards rushed in and had the prisoners back in their cells within minutes.

To make it impossible for such an attempt to go undetected, foot-shooped guards called "prowlers," patrol the corridors during the night. In case of trouble, the operator at the first suspicion of trouble. So that prisoners cannot learn his habits, a prowler never follows the same route twice. As he goes from cell block to cell block, he punches signal buttons, causing corresponding red lights on a glass screen in the central switch board to mark his progress. Should a light remain stationary too long, the operator calls the guard back, if he does not respond other guards hasten to the scene, ready for action and warned that an emergency has undoubtedly arisen.

Since elevators afford the only access to the jail, outlaws attempting to storm it and effect a jail delivery would find themselves in a trap of their own making. Armed guards, warned over the alarm system by the elevator operator and barricaded behind steel doors, would meet the entering gangsters, while deputies downstairs would cut off their escape. Meanwhile, cell blocks, automatically locked would prevent prisoners from participating in the conflict.

FARM RUINED BY BLACK ALKALI

This farm land, near Fresno, Calif., has been transformed into barren waste by the invasion of black alkali. The picture shows the complete failure of the barley crop to which it was planted. At top of opposite page photo of same land reclaimed by a treatment of gypsum and sulphur and raising cotton.



Barren Alkali Lands

Millions of Acres Reclaimed for Farmers by Ingenious Means that Remove Poisonous Salts



A hard soil is forced through a set of filters, one of which is seen in the foreground, and resulting solution analyzed.

perial, Sacramento, and San Joaquin, are heavily impregnated.

Ever since an ancient Arabian farmer found that on burning certain plants he obtained an ash with a biting, bitter taste—which early Arabians termed "kalay," meaning "to burn"—men have hoped in vain to free their unproductive soils from the blight of alkali that destroys fertility.

Some areas in the western states became alkaline because there was insufficient rainfall to carry away the salts formed by the weathering of volcanic rocks. In other cases, salts accumulating underground

perial and San Joaquin valleys. Fourteen years ago, they started the work which has just culminated in success.

Their first battle was against black alkali on a farm near Fresno. In the late 1880's, an irrigation company brought water from the King's River to this area and miles of vineyards were planted. At that time, with an annual rainfall of six inches, the ground water stood eighty feet below the surface.

Fifteen years later, the water level had climbed through this porous alluvial soil until it stood only one to three feet below the surface, within easy reach of plant roots. At the end of this time astonished vineyardists looked out across 60,000 acres where the soil killed instead of nourished.

UNCOUNTED millions of acres of the world's finest agricultural land, blighted by plant-destroying alkali, may again become fertile fields as the result of a discovery made by three western scientists.

Dr. Walter P. Kelley, University of California soil chemist, and his two associates, E. E. Thomas and S. M. Brown, have solved a riddle that baffled American Agricultural experts for half a century. They have unlocked the secret of alkali the desert salt which, in the United States alone, has turned 20,000,000 acres of farm land into barren wastes.

In large areas of California, Arizona, New Mexico, Colorado, Wyoming, Nevada, Montana, Idaho, Washington, Oregon and Nebraska, alkali has driven the plow from the soil. Death Valley in California and the Lahontan basin, in Nevada, bear testimony to its desolating power. In the Nevada valley, not a trace of vegetation remains and salts may be raked from the surface in great quantities. Nearly 4,000,000 acres in three California valleys. Im-

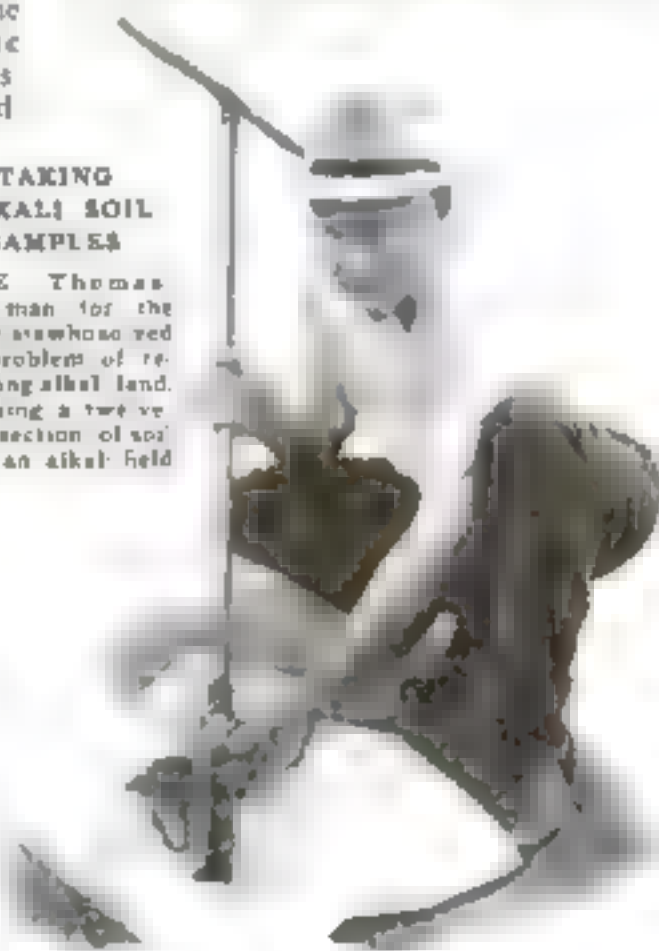
have been brought to the surface as irrigation caused the water level to rise.

Common table salt, Glauber's salts or sodium sulphate, and soda are the most frequent forms in which the alkali appears. It is of two general types; white and black. In the white alkali, sulphates and chlorates predominate, in the black, carbonates. The concentration of these elements in the soil has strangled farm lands and defeated civilizations in Egypt, Asia Minor, parts of India, and is now at work in our own Southwest.

In battling this constant threat to agriculture, the California scientists made elaborate tests of chemicals and water. They took tens of thousands of samples of soil and analyzed them in unique pressure chambers in the laboratory. They established experimental field stations in the Im-

TAKING ALKALI SOIL SAMPLES

E. E. Thomas field man for the experiment station, is taking a twelve inch section of soil from an alkali field.



By
ANDREW R. BOONE



Made Fertile

The affected areas expanded rapidly as the water spread and salts climbed up tender plant roots and suffocated them. It seemed as though the entire San Joaquin Valley was doomed as a result of the spreading of the poisonous blight of alkali.

Capillary attraction drew the salty water to the surface exactly as oil rises in a wick. Draining away the water was the first problem. But it was not the only one.

Several years before Kelley and his associates tackled the problem, an attempt to reclaim the land had appeared to be successful for a time. Then, figuratively speaking, the patient had died. Something had happened to the soil other than a mere accumulation of salts. What could it be?

Carrying curious earth augers, Thomas, one of Kelley's associates, began to honeycomb the unproductive fields. He sent more than 10,000 samples two miles of them, back to the laboratory at Riverside, Calif. These samples, taken in twelve-inch sections to a depth of four feet or more, were collected on clean cloths and packed in special bags. Kelley studied them carefully. All had one peculiarity. The soil refused to form lumps or flakes. Adding water, he poured the muddy mixture into chambers where compressed air forced the solutions through porous clay, straining it into vessels set below.

These clear solutions were then analyzed by test tube and by electrical measurements. They all showed the presence of sodium salts. The next step was to add salts in varying combinations to handfuls of soil. Soon, these tests revealed an illuminating fact.

When the salt was added to the soil, the sodium replaced calcium in the clay and turned it into sodium clay. Being insoluble, sodium clay cannot be washed from the soil. It makes clay impervious to water sticky when wet, very hard when dry. Such soil cannot be prepared for planting wet or dry. Simply draining off the underlying salt water would not solve the problem in such a case, as the insoluble sodium clay remained behind.

HOW SCIENCE FOUND WAY TO BEAT ALKALI

Right now a hard soil is packed in the eight cylinders. Water is added and then compressed air forces the solution out into the bottle. This relatively clear solution is then analyzed. Below, analyzing alkali soil by means of a potentiometer. It was in this way that the restorative power of gypsum and sulphur when added to alkali was discovered by Western scientists.



The key to this chemical riddle was found in efforts to produce synthetic black alkali in the laboratory. What was needed was water working in combination with some chemical capable of penetrating the earth and turning sodium back to a sulphate which could be washed away and drained into the sea.

Laying out plots at the Fresno experimental station, the scientists tested various chemicals. Eighty-four different enclosures were treated with chemicals and combinations of chemicals in the search for the needed substance that would bring relief to countless acres in many countries.

The laboratory experiments indicated that



gypsum and sulphur were most likely to succeed. On several plots

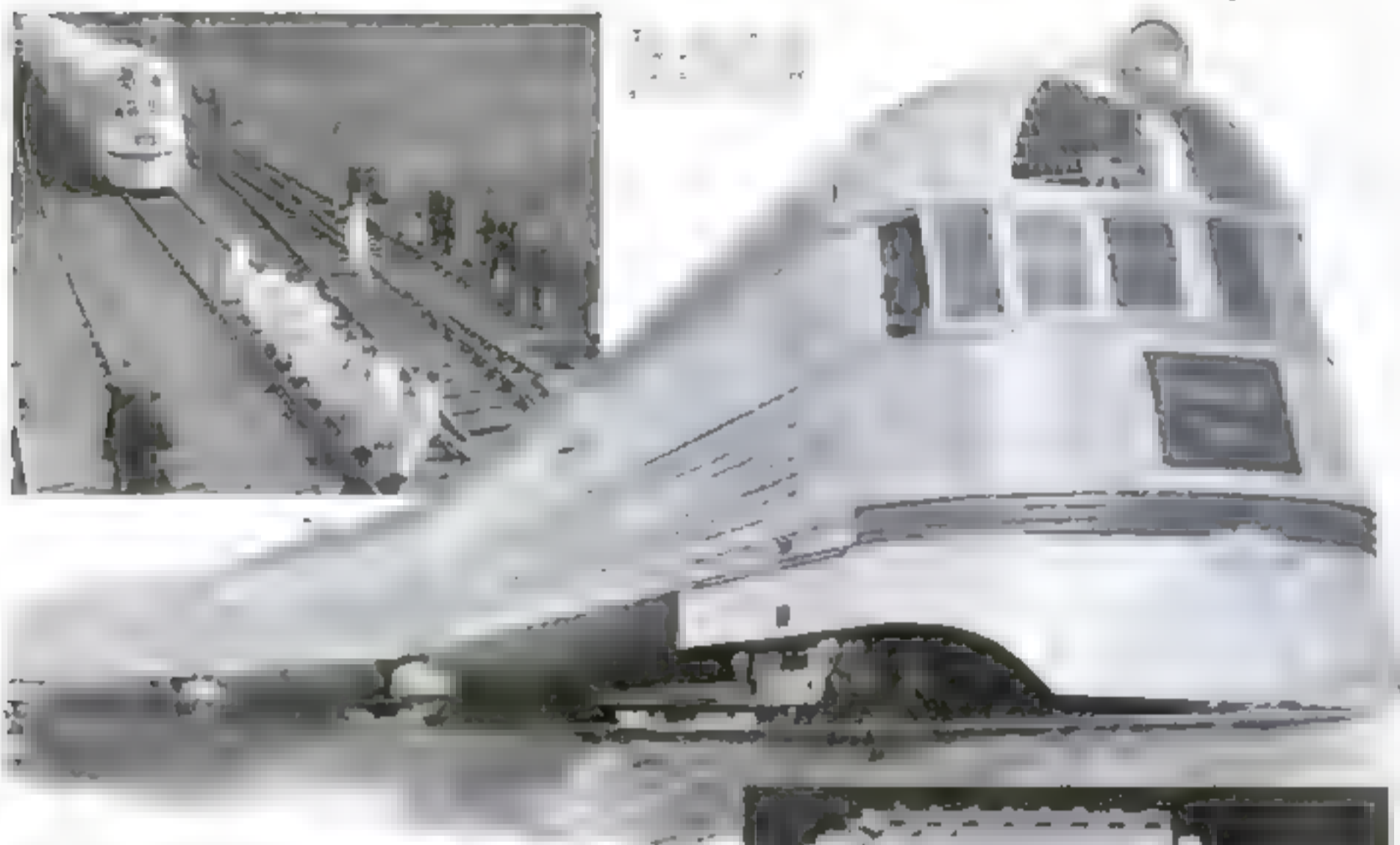
they leveled the land, spread gypsum on the surface, plowed it under, and then flooded the land. At the same time, they set about lowering the water level, or table, as it is called, beneath the fields. Pumping eight months day and night from a well sixty-eight

feet deep, they lowered the water table nearly five feet. This took it so low it could not possibly reach the roots of any crop.

That winter the gypsum-treated plots were seeded to alfalfa. Since then, they have been kept in alfalfa almost continuously, with spectacular results. The first year they yielded six tons to the acre, the second nine tons, the fourth, nearly ten tons. Land twice abandoned was giving these sensational crops while neighboring fields were producing only from four to five tons.

Even with these results, the scientists did not feel that gypsum promised the full test success. They (Continued on page 111)

New Streamlined Train Has 125-Mile Speed



SO LITTLE in weight, the new streamlined train which will be known as the "Zephyr" recently completed for the Chicago, Burlington and Quincy Railroad. It has already attained a speed of 104 m. per hour and it is estimated by the engineers that it is capable of hitting a top speed of 125 miles an hour. Constructed of stainless steel, the train consists of three units and is 90 feet in length. It will operate on electric current from a generator driven by an eight-cylinder 600-horsepower two-cycle Diesel motor. The



engine develops as much power as a four-cylinder type weighing forty percent more. Like the three-car streamlined Union Pacific train which was delivered a few months ago (P. S. M., Apr. 34, p. 41), the



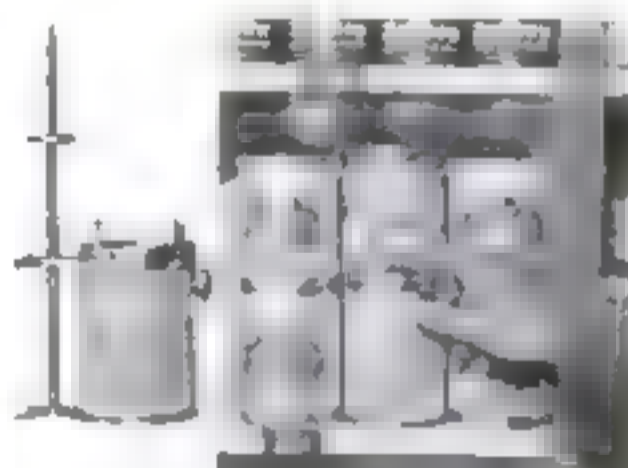
new train is shaped to minimize air resistance and equipped with shatter-proof glass and roller bearings. The train will go into service between Kansas City, Mo., and Lincoln and Omaha, Neb.

PNEUMATIC TUBES TO SPEED AIR MAIL

A RECENTLY constructed model of a "flying post office" visualizes how air mail would be speeded by running underground pneumatic mail tubes to outlying airports. Mail would be sorted aboard a plane in flight into torpedo-shaped containers. When the plane landed, the containers could be dropped into the mail tubes and shot by compressed air into the heart of the nearest city. If the plane did not stop for mail, it could drop the containers into a net without landing.



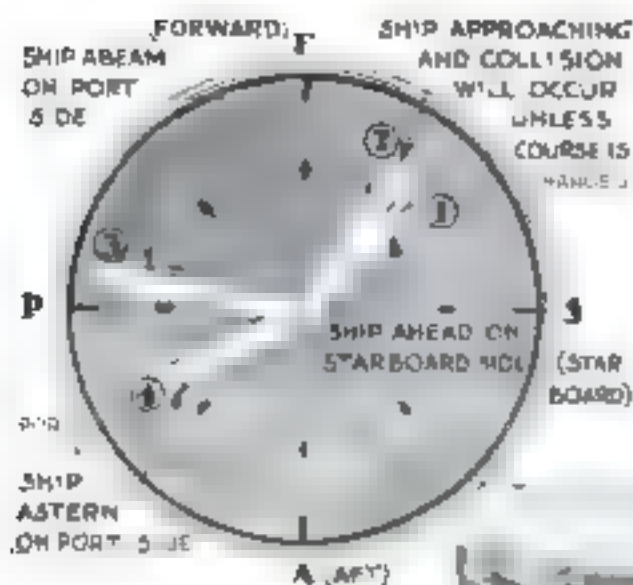
Interior of post office installed in airplane for the purpose of distributing the mail to pneumatic tubes for delivery to the city offices.



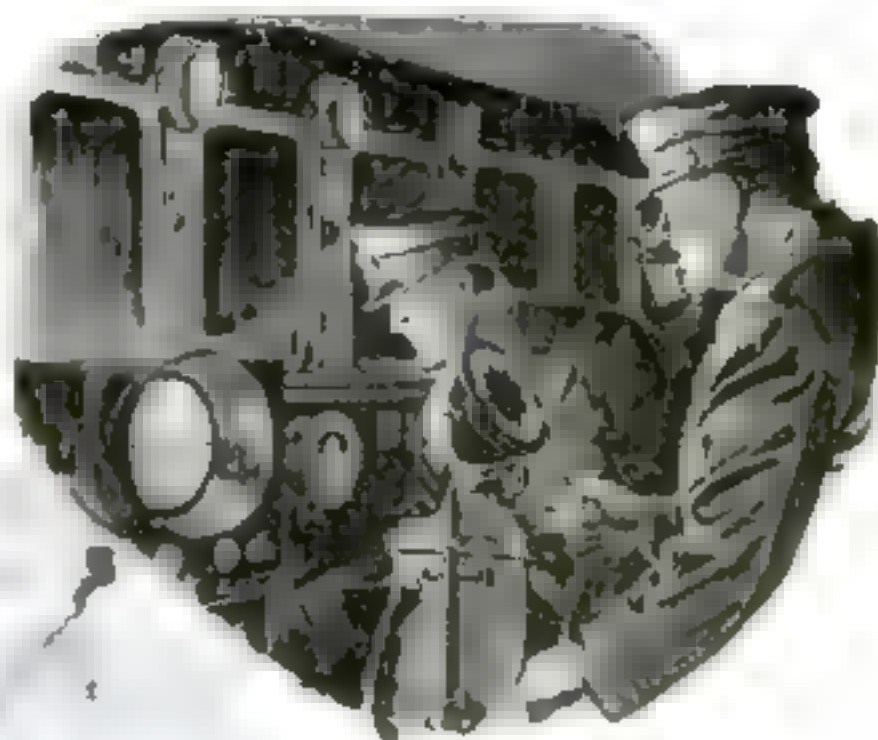
ROTATING JAR DISPLAYS FOODS HIDDEN IN CANS

SO THAT housewives may get an advance view of canned foods they are purchasing, transparent sample containers have been introduced for display on grocery store shelves. The containers are filled with fruit or vegetables of the same kind as that contained in actual cans immediately adjoining. By turning a knob at the base of the sample jar, the customer may rotate it and scrutinize the contents.

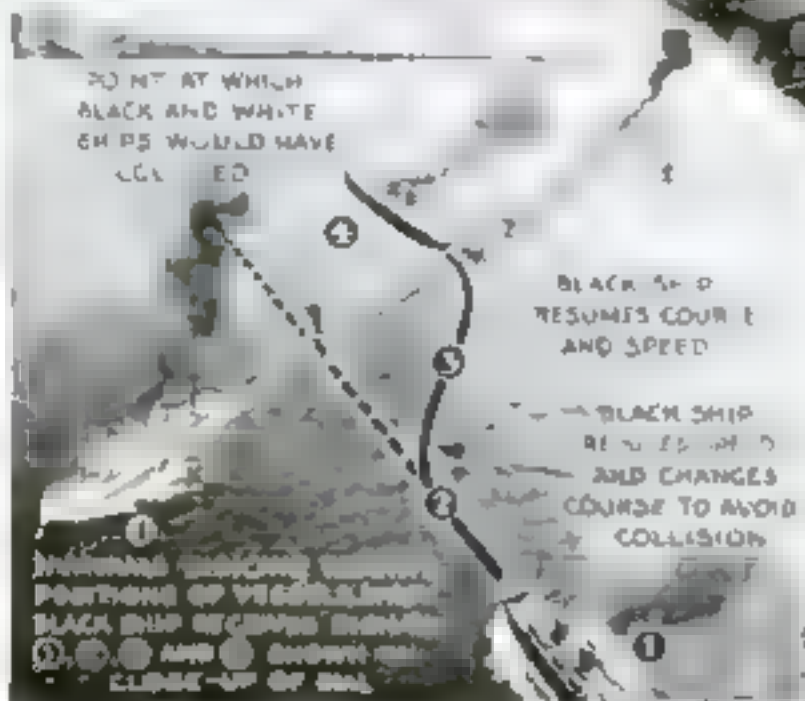
Cathode Ray Guards Ship in Fog



Left, close-up of cathode-ray dial shows how the luminous signals are interpreted by ship's officers so that position of unseen ships can be determined. At right the collision-preventing device is pictured in use. Below, diagram showing how collision at sea would be avoided by use of the cathode ray device.



LUMINOUS arrows on a compass dial warn ship's officers of the presence of another vessel and prevent collisions in fog. The new instrument is a cathode-ray device developed by experts of the British government radio research station at South Foreland. The only requirement for its operation is that all vessels emit a momentary radio signal of 100-meter wave length at fixed intervals of fifteen or twenty seconds. Two fixed loop aerials of standard marine direction-finder type pick up the signals, which cause luminous lines or arrows to appear momentarily on a window marked



off with the points of the compass. The window is the screen of an indicating device known as a cathode-ray oscillograph

whose electrical circuit is so arranged that the direction of the arrow indicates the position of the nearby ship, while the arrows increase in length as it approaches. Thus the course of an unseen vessel may be plotted. A speed scale is also visible. An arrow of varying direction and increasing length warns that a collision is imminent unless the course is changed. Tests of an experimental receiver of the new type have shown a radius of detecting vessels within a radius of ten miles. If the system is internationally adopted, all fog-bound ships will send out signals every twenty seconds, the signal lasting only a small fraction of a second.



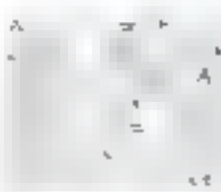
UNBROKEN LINE OF LIGHT IN NEW TUBULAR LAMP

AN UNBROKEN line of light for display cases, show windows, and other places where space is limited is made possible with a new type of tubular lamp. This lamp which is nearly eighteen inches long and one inch in diameter has a thin metal contact cap sealed directly to the glass at each end, so that any number of lamps may be placed end to end for the purpose of giving continuous illumination.

PHONOGRAPH USES LONG PAPER RECORDS

USING paper strips instead of composition films, a new photographic device capable of reproducing a complete concert without interruption has been placed on the market in Austria. The method employed is similar to that used in recording sound pictures, except three sound tracks are printed instead of one, thus making it possible to record 3,000 feet of sound on 1,000 feet of film. The paper strips are

printed from this master film. The records, in the reproducing machine, pass before small lamps and the reflected rays from the records actuate a light-sensitive cell and through an electric pick-up are reproduced as sound in a loudspeaker. The reproducer automatically shifts from one sound track on the record to the next. A reel of record costs less than a single conventional phonograph record and the reproducer is also less expensive than the ordinary type.



FIFTEEN-FOOT PLANE

FLIES 120 MILES AN HOUR

SMALL enough to use a two-car garage as a hangar, and weighing less than a standard motorcycle, a midget airplane, built by V. L. Payne, a former instructor in designing for the Army Air Corps, is said to be capable of flying 120 miles an hour. The wingspread is only fifteen feet and the length is eleven and one half feet. The plane weighs 400 pounds and is powered by a nine-cylinder French radial engine developing fifty horsepower. The plane is expected to make a strong appeal to private flyers.



Midget plane, weighing 400 pounds, with fifteen-foot wing spread, has top speed of more than 120 miles an hour.

AUTO BRAKE SELF COOLED

A SELF-COOLING lining, recently placed on the market, is said to assure longer life and smoother action for automobile brakes. In the manufacture of the lining, a graphite flux, containing vaporized lead, is forced into holes that extend from surface to surface, forming a series of plugs. The metal contained in the plugs transmits heat freely between the drum and shoe when the car brakes are applied, aiding in dissipating the heat rapidly into the air.



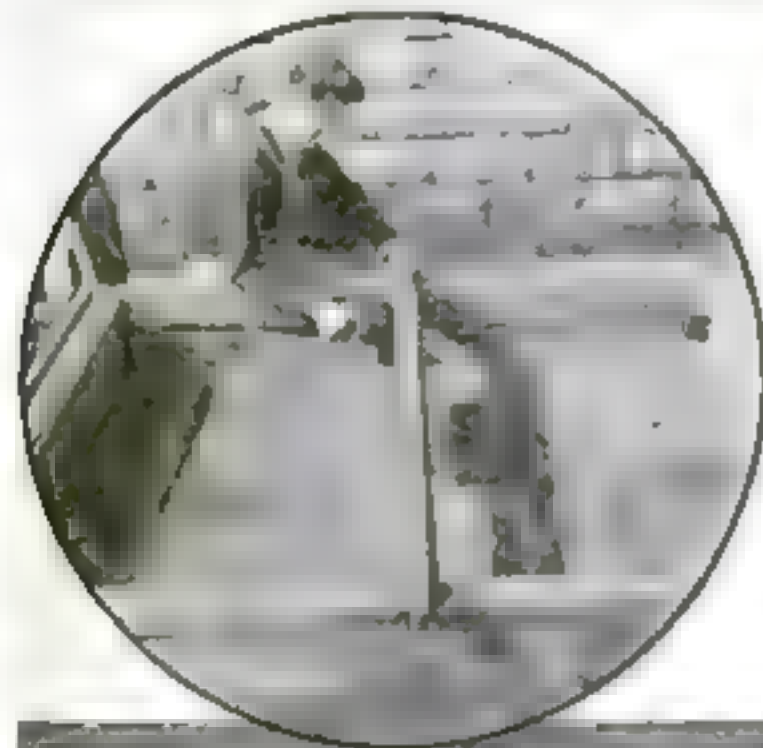
Metal plugs make this brake lining self cooling.

HATS PROTECT ROSES AT FLOWER SHOW

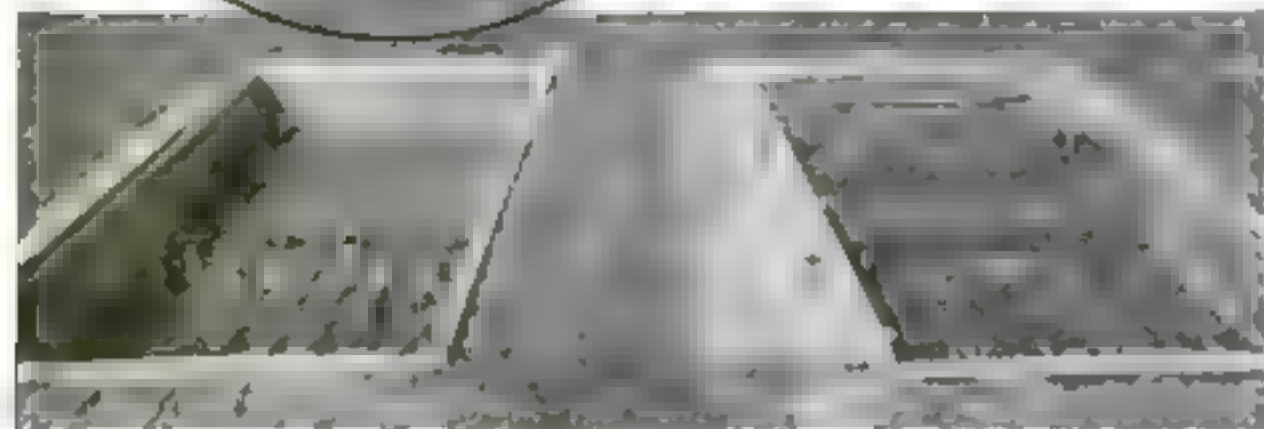


ROSES wearing hats to protect them from sunlight were seen by visitors to Horticultural Hall, London, just before a recent flower show opened. Considerable money and weeks of care had been expended by the growers in raising the prize roses for the exhibition, and no chances were taken that sunlight entering into the exhibition hall before the show opened, might cause their colors to fade or force a too rapid unfolding of the delicate petals.

SURFACE ELECTRIC CABLES HEAT HOTBED



...eding plant growth in is made more effective by a new method devised at the University of Maryland. Heating cables are laid on the surface of the earth, departing from the usual practice of burying them, with a reported saving of as much as forty per cent in power consumption. Plants grow in close proximity to the 110-volt lead sheathed cable without apparent injury.



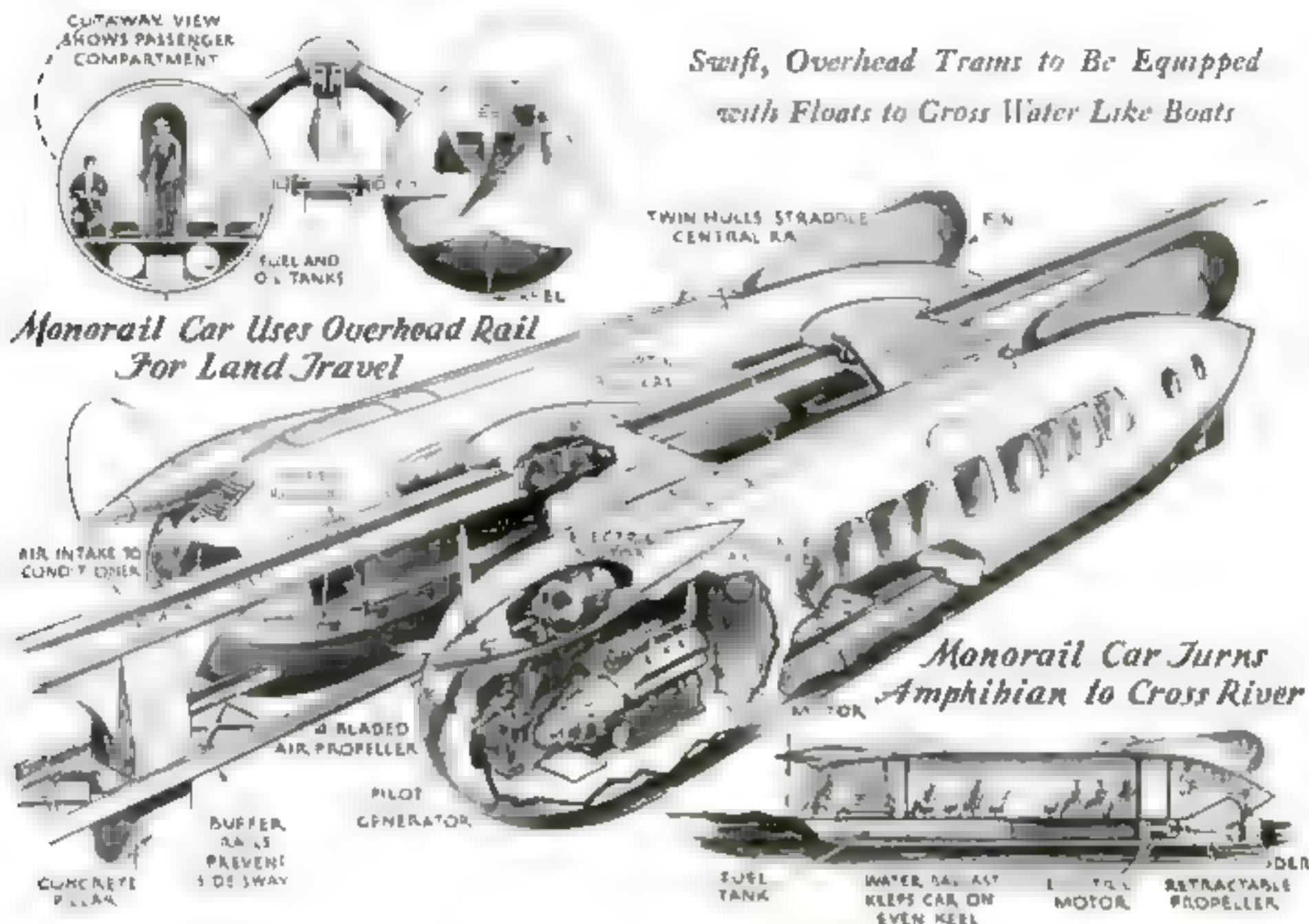
In circle, installing surface heating cables. Left above, bed with buried cables, and, right, surface cables.



DESIGNS STEAM TURBINE TO POWER AIRPLANES

EXPERIMENTAL a plane that exceeds a hour a horsepower steam turbine shown above has been developed by a German inventor. He has also devised a rotating boiler that generates steam. The first man-carrying plane to employ steam power, flown in his country last year (P.S.M., July, '33, p. 9), used a reciprocating steam engine.

Twin Amphibian Cars for Monorail



Swift, Overhead Trains to Be Equipped with Floats to Cross Water Like Boats

Monorail Car Uses Overhead Rail For Land Travel

Monorail Car Turns Amphibian to Cross River

AMPHIBIAN trains that can whiz above desert sands on an overhead rail, or plunge into the water to ford a river are contemplated by the Soviet Government in an amazing plan to tap Russia's wealth in Turkestan. They are to travel on three projected monorail lines of unprecedented design, totaling 332 miles in length and crossing deserts and rivers.

A single overhead rail on concrete standards could be erected at low cost along these routes, engineers estimate. Air-propelled cars with twin, cigar-shaped hulls could straddle the track and glide along it at speeds reaching 130 miles an hour, according to calculations based on tests of models at Moscow. The cars would be equipped with Diesel-electric drive, and

each one would carry forty passengers or an equivalent freight load. Where the longest of the projected routes crosses the river Amu-Darya, a mile and a quarter wide, it is proposed that amphibian cars be used. On arriving at the shore the cars would leave the overhead rail and cross the river as a boat. Soviet engineers are reported already surveying the route.

DRIVER'S SCARF HEATED BY CAR



A heating element woven into this scarf is attached to car's battery at dashboard outlet and electrically heated.

AN ELECTRICALLY heated scarf for the comfort of open-car drivers on cool evenings has been devised by a Los Angeles, Calif., inventor. An electric heating element is woven into the fabric and a flexible cord attached to one end of the scarf is plugged into an outlet in the dashboard and connected with the electrical system of the automobile exactly as a cigarette lighter is worked.



CAMERA ON GUN TO TRAP CROOKS

PHOTOGRAPHIC identification of fleeing criminals may be obtained with a recently perfected camera which is attached to a pistol or rifle and worked by the gun's trigger. The lens used can work at an opening of F 3.5 which permits the camera to be used in comparatively poor light and at high speed. The small negatives are sharp enough to be enlarged.

New Glider's Propellers Worked by Foot Power



This glider is now being constructed in Germany to test the inventor's idea of driving its propeller by foot power like a bicycle. In this way he expects to keep control of the machine in flight.

A GLIDER now being built in Germany is equipped so that it can be propelled by human power. When the pilot turns pedals located beneath his seat, power is transmitted to a propeller by means of bicycle chains and reduction sprockets. Although the propelling force developed is not great, it is expected that the glider will be easier to control than one that is flown without power and as a result its inventor says it can be kept in the air for a longer time.

DROPPING SAFETY MATCH EXTINGUISHES IT

If ACCIDENTALLY dropped while lighted, a new safety match patented by W. H. Kobbe, New York chemist, extinguishes itself. The end opposite the tip is weighted by dipping in metal or is made of heavier stock than the rest of the stick. The weighted end falls first, drawing the flame away from the unburned portion and extinguishing it. At present, dropped matches are a principal cause of America's huge annual fire loss.



FLASH-LIGHT CELLS RUN ELECTRIC VIBRATOR

AN electric vibrator designed to operate on flash-light cells, instead of house current, has been introduced for use by travelers and by those whose homes are not wired for electricity. The device, shown above with its attachments, is declared by the maker to compare favorably in operation with standard types, despite its low power.

DIVINING ROD HUNTS



Scientist the divining rod used to hunt minerals in the Antarctic. The electrical device buzzes when near metal.

GOLD IN ANTARCTIC

THE belief that precious metals are buried in the continent of Antarctica may be confirmed or exploded by a scientific divining rod carried by the second Byrd expedition. On the first expedition, Dr. Laurence M. Gould, University of Michigan geologist, found coal deposits that led him to declare the coal reserves of Antarctica second only to those of the United States. Now with the new divining rod an effort to detect metallic deposits will be made.

Inventing Puzzles is Hobby of Professor

WHEN C. A. Jacobson, professor of chemistry at West Virginia University and the inventor of numerous pieces of laboratory equipment and a calculating machine, needs diversion, he turns to constructing puzzles. His interest in puzzles dates back forty years and he has been inventing them for more than twenty-five. His latest is a complicated block puzzle of unusual construction. One form of this puzzle is intended for use as a base for an inkwell. Professor Jacobson is shown here with a few puzzles from the huge collection he has acquired. One of Jacobson's earliest puzzles was purchased by the famous Jack London.



TYPEWRITER REPLACES TYPESETTER IN NEW METHOD OF COMPOSITION



Above in new printing method an ordinary typewriter is used and area are stretched as is shown at far left

PROMISING a new departure in the methods of printing books, newspapers, and periodicals, a recent invention enables any typist to produce perfectly aligned columns of copy with an ordinary typewriter, since it corrects the usual irregularity of the right-hand margin. The resulting copy may be reproduced by standard photo lithographic methods, eliminating the need for present-day typesetting, matrix, and stereotype equipment. A sample of the new typewriter printing is shown in the center illustration above.

According to the inventor, girl typists, by the system, can do the work of linotype operators employing equipment costing thousands of dollars. The invention that makes this possible is a patented paper sheet that is slipped in a typewriter and written upon in the usual way, with no special effort at alignment. The writing falls upon parallel horizontal strips of a tough, thin, and finely-crinkled tissue, which are affixed to a paper backing with a special cement that remains permanently

plastic. After the sheet is removed from the typewriter, each strip in turn is grasped at the right-hand end with tweezers, after from its backing, stretched to an alignment mark and stuck down again. For practiced hands this operation is simple and rapid. The type used is not distorted, since the fibers of the tissue tend to lock together where a type bar has made an impression, and the stretching of the tissue occurs in the spaces between individual letters and between words.



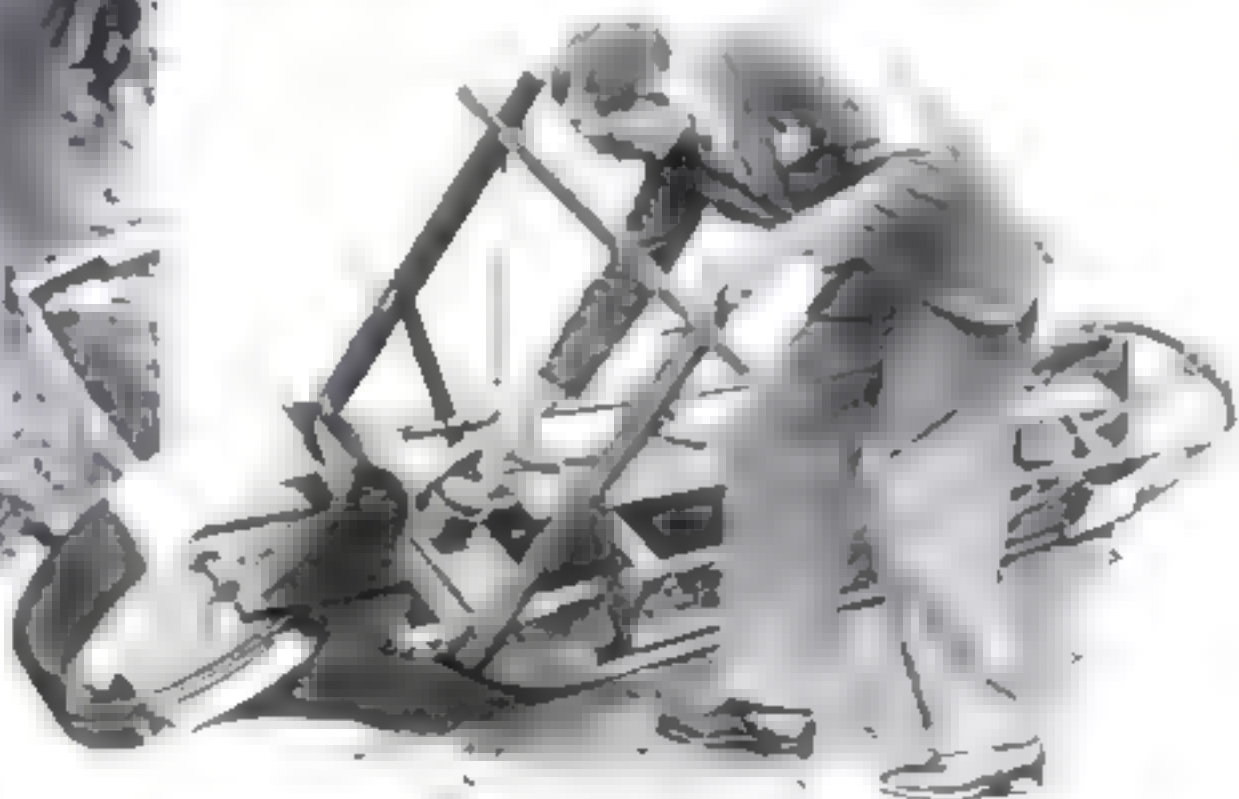
TWO MEN AT ONCE SHOT FROM CIRCUS CANNON

Two men, shot from a cannon at once, soar through space at 155 miles an hour to provide a new thrill for circus fans. The two dare-devils, Hugo and Victor Zachiani, describe a high arc and land in a safety net as is seen in the unusual photo of this thrilling act reproduced above.

WHEEL ON SLED GAGES EXPLORER'S TRIP

Equipped with modern devices, the sledges which a British expedition led by Lieut. Martin Lindsay, will take into Greenland will present a strange appearance in contrast to the traditional

type. The expedition, which will explore the vast interior of the island hitherto never thoroughly mapped, will use sledges carrying a compass and trailing a wheel. By means of a revolution counter, this wheel will record the distance traversed much as a car's speedometer does.



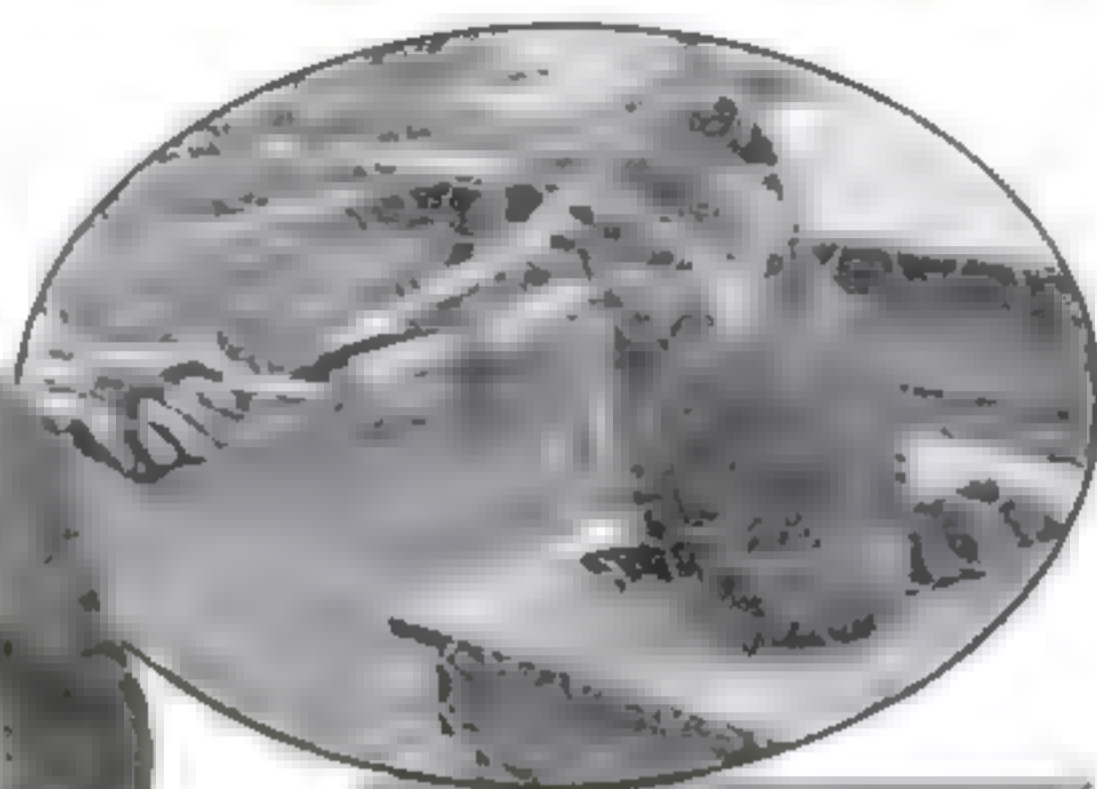
The wheel on this sled to be used by Greenland explorers, is attached to a revolution counter so that a record of the distance traveled is kept automatically and accurately.

Raccoons for Hunters

REMARKABLE METHODS ADOPTED TO SAVE



Young raccoon on the Ohio State farm. It is tame but like all of its kind, it has an uncertain temper and resents, with its teeth, rough handling. This one is about the age at which they are turned loose in the woods.



Above, pet raccoon reaching through wire net for chewing gum. Note humanlike hands. Right, an angry raccoon with teeth and claws bared ready for a fight.



By

GROVER C.
MUELLER

IF YOU ever go raccoon hunting in Ohio, the chances are that the ring-tailed quarry your dogs find and hold at bay in a tree spent the early months of its life on an unusual farm almost within sight of the boyhood home of Thomas A. Edison. For more than two years, the State of Ohio, using money obtained from the sale of hunting licenses, has been operating a raccoon farm at Milan, not far from the shore of Lake Erie. This farm, believed to be the only enterprise of its kind maintained by a state, was established in an effort to prevent the extinction in Ohio of one of the gamest of native animals.

A generation ago a coon hunt was as common as a game of checkers. There were plenty of raccoons and plenty of trees in which they could live and seek safety. In recent years, however, the raccoon population has been dwindling at a rate so rapid as to cause alarm.

Consequently, the coon hunt, formerly so popular and fruitful, became in Ohio, a matter of exercise only. There were not enough coons to provide really good hunting. In an effort to remedy this condition, William H. Reinhart, Conservation Commissioner, secured the establishment of the Milan farm. Hunters were paying money for the privilege of hunting raccoons and other animals, so it was logical that these funds should be used to maintain the farm. Not a cent of taxpayers' money was used and the land was donated by civic interests of Milan.

Raccoons raised on the farm are dis-

tributed in equal numbers throughout the eighty-eight counties in Ohio. The animals are placed in trucks during the latter part of September and are liberated near wooded areas where they find homes.

Between the time the raccoon is liberated and the opening of the hunting season on November 15, there is plenty of opportunity for it to forget its domestication and to become a wild animal as full of fight as if it never had known a wire coop.

As many as 2,000 visitors have been admitted to the farm on a single Sunday. Incidentally, the farm is open to visitors after the middle of June, but is closed before that time as a female raccoon does not like to be disturbed when raising its young and in fright may kill them.

The zoologist will tell you that the raccoon is closely related to the bear. As you watch a coon pacing back and forth along a beaten path at one side of its cage, you can see that its gait is very much like that of the bear. Doubtless that is because the two animals, as well as man,

have plantigrade or semi-plantigrade feet, which means that they walk on the soles of their feet, with heels touching the ground. While a full-grown raccoon is a little larger than a cat, its fur is so heavy that it looks two or three times its actual size, especially when in a rage.

The Milan farm produces normally the black, part black, and gray varieties of raccoons. The gray, or silvery, coon is the most commonly seen in the wild state and is the common source of the coats usually associated with college men. The grayish hairs are tipped with black, and there are black and white patches on nose and cheek. The tail is ringed.

Last year, when the young were being counted, E. L. Striff, caretaker, was astonished to discover two coons that were pure white in color. These have attained their full growth and are now the prize

Grown on State Farm

GAME ANIMALS FROM EXTINCTION

possessions of the farm. It is unlikely that the white raccoons will be liberated. They are somewhat of a rarity and their pelts are valuable. The white raccoons are sports, or albinos. This means that hereditary traits so combined that coloring material was omitted from their make-up. Consequently, they have white hair and colorless eyes, a condition that not infrequently occurs among human beings. Experiments are being planned to see if a strain of white raccoons, like white rats, can be maintained. Incidentally, these animals resemble overgrown rats more than anything else.

The raccoon is a highly independent animal, able to take care of itself anywhere. It has been the experience of the farm staff that coons are among the healthiest animals ever raised in captivity. If normal care is given to their diet, they will thrive readily. They are remarkably free of common animal diseases.

One of the entertaining traits of a coon is its apparently limitless curiosity. It will examine any strange thing that comes in its way. Its paws resemble the hands of monkeys and are equipped with needlelike claws. The raccoon is an expert excavator and can dig holes with ease.

Among American animals the raccoon is surpassed only by the bat and the flying squirrel as a lover of night life. During the daytime the raccoon sleeps. For this reason, the Milan coon farm frequently looks deserted to the visitor. As evening approaches, there is a stir of activity in every cage, and at night the inmates are up and about. Every coon hunter knows that he and his dogs can do their tracking best at night.

So important is a tree den in the lives of raccoons and squirrels that Ohio conservation officials have started a movement, through sportsmen's organizations, to save the existing hollow trees in which these animals live. A land owner has a dead or dying tree on his place, and to him it is merely an eyesore or a potential source of firewood. He cuts it down without thinking that, to a family of coons or squirrels, it is home sweet home; and when the home of a wild animal is destroyed, it is more difficult for that animal to protect itself and raise its young. When a coon cannot set up housekeeping in a hollow tree, it may seek out a stream and live along the banks, for by nature it is a water-loving animal.

The movement includes the creation of new tree homes for coons and squirrels. Hollow trees whose openings are too large for the animals can be partially filled or closed so as to render them habitable. Trees that are decayed but not hollow can be opened up. Hollow trees with openings too small for occupancy can be enlarged. Of course, such operations are undertaken only when the tree is not useful to the owner of the land for any other purpose.



Main building of the Ohio raccoon farm. Any sportsman who pays for the privilege of hunting for coons or squirrels must first obtain a license from the Division of Conservation.



Full-grown, gray raccoon ready to be released in the woods for the hunters

A raccoon will eat almost anything. Feeding schedules at the state farm call for a wide variety of food, with a preference for vegetables rather than meats

during the hot season. Lake Erie, a few miles away, provides an abundance of fish. Large quantities of milk are used. Green corn, {Continued on page 112}

Below, the tongue of a pond snail as it appears when seen through your microscope. This resembles your workshop sanding belt.



Dissecting the tracheae of a cricket under water. A watch crystal is used as the dissecting dish and the tracheae are teased apart with very fine needles. Under the microscope these parts appear amazingly like many of our ingenious man-made instruments.

MICROSCOPE PROVES Insects Were World's

By MORTON C. WALLING

MANY of the things you have regarded as inventions of the present scientific age are not inventions at all, but merely man-made imitations of tools and equipment developed ages ago by the insects. If you doubt this, you have only to turn to your microscope. Through it you can examine marvelous devices that have been in use for millions of years, and which sometimes are strikingly like familiar man-made tools.

Upon examining a vacuum cleaner, you find attached to it is a length of rubber and fabric hose reinforced with wire in the form of a spiral. You have seen similar reinforced hose in factories and on air lines at gasoline stations.

Now go out into the field and capture an insect. Almost any kind that is not too small will do, but a honeybee is preferable because you will find so many interesting gadgets on it. Just now, however, you are on the trail of the first air hose. With your scalpel, remove the bee's abdomen, the part forming the rear segment of the body. With fine-pointed shears slit the abdomen along the top or the bottom, and tease the contents apart with dissecting needles. This is best done on a watch glass containing a teaspoonful of water. With a hand lens or a low power of your microscope (ten to fifty diameters) you will find floating about in the water little sections of tubes, some of them branched. Transfer some of these pieces to a slide and examine at 100 diameters or more.

The tubes, you observe, are not smooth-walled. Instead they are prominently ridged. Here is a piece that has been torn forcibly from another section. From its end extends a kinked thread. Upon close examination, you find that the thread is part of



Sharp teeth on this drill cut wood.

the spiral lining of the tube. Now the structure is clear to you: The tube consists of a thin membrane lined with a coil spring made of thread-like chitin. It looks for all the world like the hose on the vacuum cleaner. It is an air tube, part of the bee's breathing system. The spiral formation serves exactly the same purpose as the steel spring in the vacuum cleaner's hose.

it prevents the thin walls from collapsing.

These air tubes, found in all insects, are known as tracheae. They carry air to all parts of the body more efficiently than life-giving oxygen is carried throughout your body because the insect gets its air direct, and not through circulating blood. Holes, in many insects guarded by ingenious valves that keep out dirt, admit air through the sides of the insect's body.

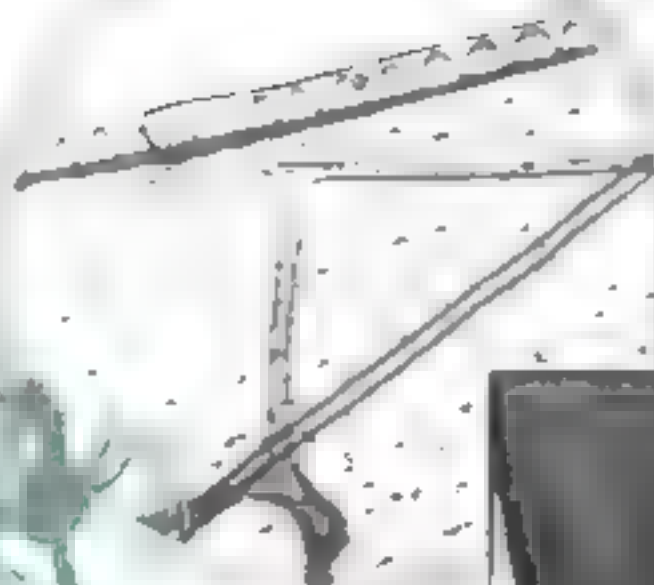
Speaking of holes recalls another group of insect-inventors, those possessing drills, shovels, saws, surgical instruments, and other equipment for cutting holes in everything from wood to rock.

The female ichneumon fly, for instance, can bore deeper holes in wood than many sugar bits found in workshops. She is equipped with an egg-laying tube that may reach a length of four or five inches. The end of this tube is fitted with sharp teeth so that she can, by moving it about somewhat like a file, cut a hole in the hardest wood. You can see the fine, sharp teeth with your microscope, if you chance to capture one of the flies. You will find that other insects have similar hole-drilling egg tubes.

If in capturing a honeybee you are not careful you may have your attention painfully called to another ingenious hole-making device. Worker and queen bees are equipped with stings, but it requires a microscope to reveal how marvelous these instruments really are. By squeezing the tip of a bee's abdomen with tweezers, you can force the sting out so you can grasp it with other tweezers. You will find that it is hard. Under the microscope you see a slender, pointed object with the large end or base flared out on one side more than the other. This is the sting case. By manipulating it with dissecting needles, you can



Right hooks on the edge of a honeybee's wing that are used to lock together the front and rear wings. Below picture shows how bee's wings appear when thus locked together.



Here is the well known bee's knee showing the wax pincher with its row of marvelously formed teeth. The bee uses these teeth to clean pollen from antennae.

How the branched tracheae of a honeybee look when viewed through your microscope. Note chitin coils to strengthen them.

First Inventors

extract two very sharp, slender spears that are equipped with several teeth sloping backwards. This formation is strikingly beautiful.

When a bee sits down on your neck, this is what happens. The sting case is forced into your skin by the powerful muscles attached to it. Then, opening from one side of the case like pocketknife blades the two spears engage your skin, the backward-slanting barbs preventing their removal. So small are these ingenious instruments that you probably would not know that you had been stung, were it not for the poison that the bee injects into the wound through the sting case.

In the realm of insects, it usually is the female that possesses the mechanical equipment. It is the female mosquito that pierces your skin on a summer evening with a noteworthy collection of instruments. Capture a mosquito and place its

head on a slide, beneath a cover glass. Projecting from the head you see a long tube. At the tip is a knob. Press the cover glass down firmly with a dissecting needle or pencil, and you can force this tube to reveal the collection of wonderful instruments it contains.

You will see two pairs of piercing instruments, sharp-pointed and keen edged. Near the tips of one pair are fine teeth, pointing backwards. There is another tube that is believed to carry into the wound a saliva that thins the blood and makes it easier for the mosquito to suck up a meal. Incidentally this saliva sometimes carries disease germs. The remaining piece of equipment is the upper lip. The mosquito carries its tool kit neatly folded inside the lower lip, the upper lip forming a cover.

The female sawfly has an egg-laying tube equipped with saws that she uses to cut slits in plant tissue. While the adult



This is the way the foot of a honeybee looks when seen through a microscope. Note the claws and the adhesive pad that make it possible for the bee to cling securely either to rough or smooth surfaces.

ily may not be easy to capture, the larvae that hatch from the eggs are well known to most persons who have raised roses or currants, because they feed on leaves of those plants.

The inventor of the steam shovel may have obtained his idea from the mole cricket. This interesting insect is equipped with a pair of fore legs that terminate in sharp-toothed scoops. With these efficient digging instruments, whose details your microscope will reveal the mole cricket burrows rapidly through the earth.

The lowly flea that lives on cats, dogs and, in some unfortunate instances, man, is equipped with a rake-like device at its head. This is believed to help the flea work its way through the hair to the skin, which it pierces with mouth parts resembling those found in the mosquito.

You could spend an entire summer looking at the mouth parts of insects, and find innumerable ex- (Continued on page 96.)



Novel slide file that holds your specimens so they are all visible and permits each one to be lifted out separately. In this file the slides are flat and there is no danger of a specimen sinking down and being lost on the slide.

Learn the New, Correct

MANY people talk about flying these days but few speak correctly the highly specialized language of the air. Even among many of the men whose business it is to design, construct, operate, or write about aircraft there is a decided looseness and confusion in the use of terms relating to the science and art of flight.

In an effort to bring about greater uniformity and precision in the use of aeronautical terms, the National Advisory Committee for Aeronautics held a conference of twenty-five experts who recently presented a list of words that probably will become the standard language of the air.

In this list aircraft is an all-embracing term that includes every weight-carrying device designed to be supported by the air, either by the device's own buoyancy or by dynamic action. But in the new air language aircraft are divided into several distinct classes—airplanes, rotor planes, gliders, and aerostats.

An airplane is a mechanically driven fixed-wing aircraft, heavier than air, which is supported in the air by the action of air against its wings. Its motive power is an airplane engine, not a motor.

If an airplane has but one main wing, it is a monoplane. If that wing is above its body, it is a parasol monoplane. If its body is between the halves of its wings, it is a high-wing, mid-wing or low-wing monoplane, depending on the position of the wing in relation to the body. If an airplane has two main wings, placed one above the other, it is a biplane. A biplane that has one wing of less than half the area of the other is a sesquiplane.

If an airplane has its propeller or propellers forward of its main wing, it is a tractor airplane, if all of the main wing is pusher airplane. A canard airplane is one having its horizontal stabilizing and control surfaces in front of its wings.

Airplanes are further classified according to the conditions of their use. An amphibian is an airplane that can take off from and alight on either land or water. A seaplane is an airplane equipped with floats—the word pontoons in this connection is obsolete—so that it can take off from and alight on the water. A flying boat is a form of seaplane whose main body, or hull, provides flotation. A shipboard plane is a landplane designed to arise from and alight on the deck of a ship.

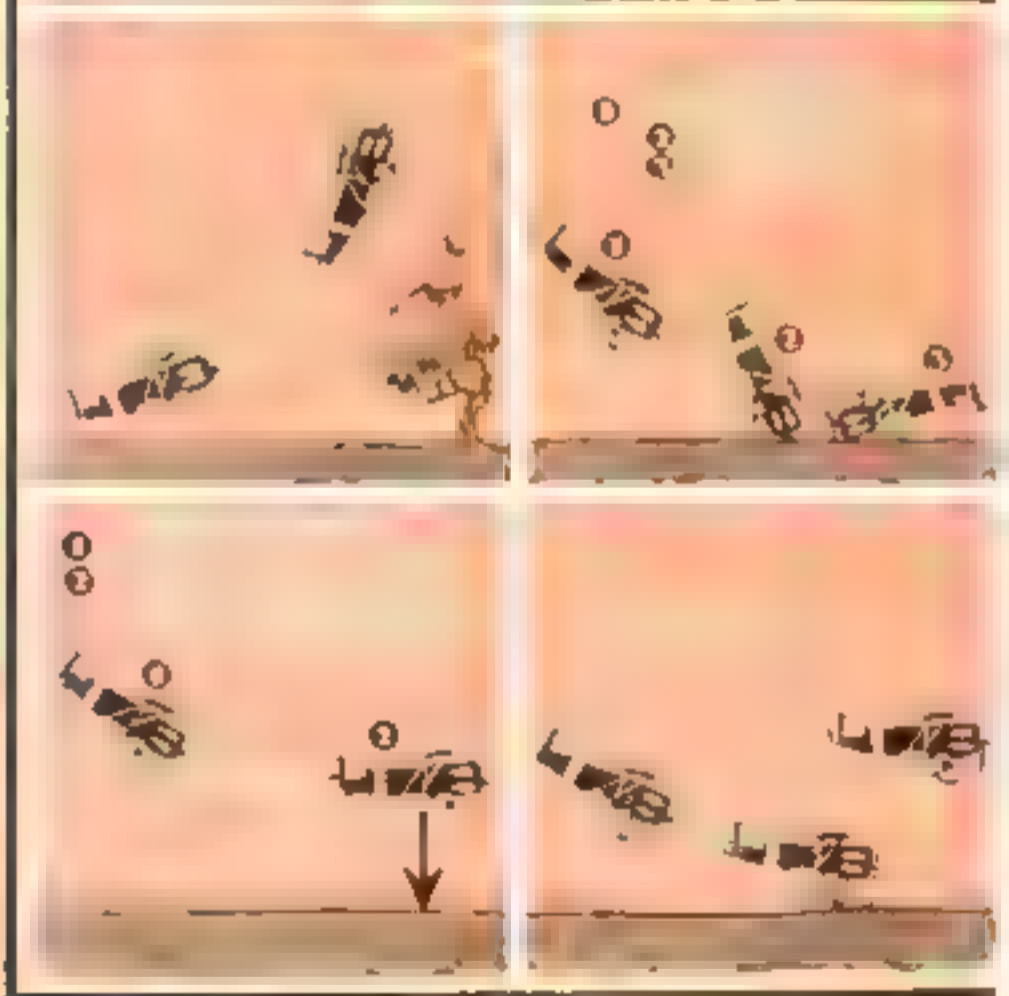
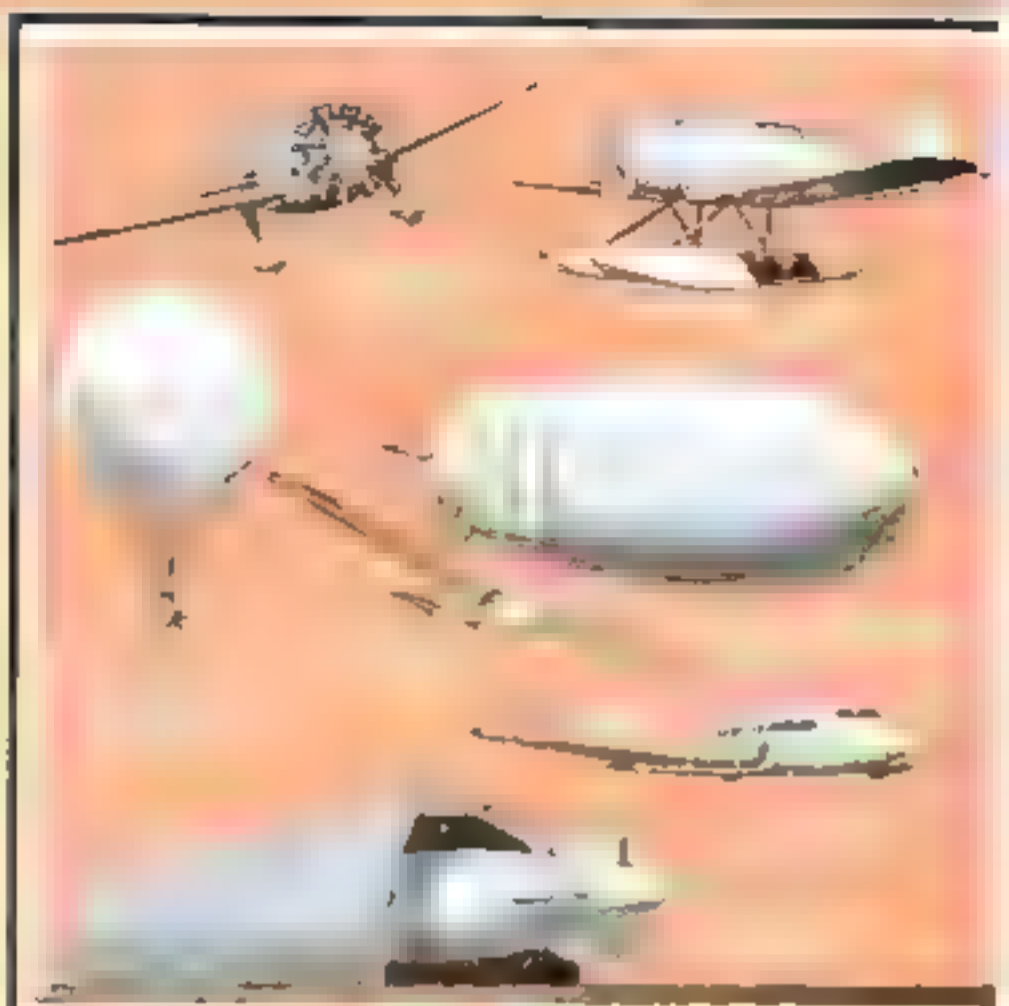
A rotor plane is a form of aircraft whose support in the air is derived chiefly from the action of rotating airfoils. There are several varieties of rotor planes—the autogiro, whose support in the air is derived from the action of airfoils rotated about a vertical axis by aerodynamic forces, the helicopter, supported by airfoils mechanically rotated about a vertical axis, and the cyclogiro, the so-called paddle-wheel plane which derives both its lifting and its propulsive power from rotating wings on either side of its body.

A glider is a heavier-than-air aircraft without a power plant. A sailplane is a glider with a low minimum sinking speed.

An aerostat is an aircraft whose support is chiefly due to buoyancy derived from aerostatic forces—a lighter-than-air aircraft. In the language of flight as now adopted, aerostats are divided into airships and balloons.

An airship is an aerostat provided with a propelling system and with means of controlling the ship's direction of motion. A balloon is an aerostat without a propelling system or steering gear and unable to move against the wind.

There are four varieties of airships. The form of a rigid airship is maintained by a rigid framework. The shape of a semirigid airship is maintained by means of a rigid or jointed keel in conjunction with internal pressure in the gas containers



Do you know them all? Illustrations show

and ballonets. A nonrigid airship, or blimp, is one whose form is maintained solely by the internal pressure in the gas bags and ballonets.

The pilot of an aerostat is always an aeronaut, never an aviator. The pilot of an airplane is always an aviator, never an aeronaut. Aviation is the operation of aircraft that are heavier than air; aerostation, the operation of aircraft that are lighter than air. An airplane is housed in a hangar; an airship in a dock. A landing strip is a part of an airport which is

Language of the Air



clearly the meaning of air terms as now used

suitable for the landing and take-off of airplanes under ordinary weather conditions; a runway is an artificial landing strip permitting the landing and take-off of airplanes under all weather conditions.

About the operation of airplanes there has grown up a colorful and highly-specialized language.

An airline (one word) is the great-circle route between two points; an air line (two words) is an established system of aerial transportation; an airway is an air route along which aids

By ARTHUR GRAHAME

to air navigation, such as landing fields and beacon lights, are maintained.

To nose-up is to elevate the nose of an airplane in flight. To zoom is to climb for a short time at an angle greater than the normal climbing angle. To skid is to slide sideways away from the center of curvature when turning. Sideslipping is the opposite of skidding. To bank is to incline an airplane laterally. A dive is a steep descent, with or without power, in which the air speed is greater than the ship's maximum speed in horizontal flight. To glide is to descend with the airplane in a normal attitude while using little or no power. Nose-over is a slang expression describing the accidental turning over of an airplane on its nose when landing. To level-off is to make the flight path of an airplane horizontal after a climb, a glide, or a dive.

There are three forms of landings. A normal, or three-point, landing is one in which a path tangential to the ground, and the loss of flying speed, are attained at the instant of contact. In making a glide landing a steady glide is maintained to the ground, without the usual leveling-off before contact. A pancake landing is one in which the leveling-off process is carried out several feet above the ground, as a result of which the airplane, in a normal attitude, settles rapidly to the ground on a steep flight path.

Acrobatics are evolutions voluntarily performed with an airplane, but not required for normal flight.

A loop is a maneuver executed in such manner that the airplane follows a closed curve approximately in a vertical plane. A normal loop starts from normal flight and passes successively through a climb, inverted flight, a dive, and so back to normal flight. An inverted normal loop starts from inverted flight and passes successively through a dive, normal flight, a climb, and so back to inverted flight. An outside loop starts from normal flight and passes through a dive, inverted flight, a climb, and so back to normal flight, the pilot being on the outside of the flight path. An inverted outside loop starts from inverted flight and passes through a climb, normal flight, a dive, and so back to inverted flight.

A roll is a maneuver in which a complete revolution about the longitudinal axis of the airplane is made while the direction of flight is maintained. A snap roll is a roll executed by a quick movement of the controls.

A normal spin is caused by the voluntary position of the control surfaces, recovery from which can be effected within two turns by neutralizing or reversing all the controls. It sometimes is called a controlled spin. An uncontrolled spin is a spin in which the controls are of little or no use in effecting a recovery. There also are flat spins and inverted spins.

A wing-over is a maneuver in which an airplane is put into a climbing turn until it almost stalls, at which point the nose is allowed to fall while continuing the turn. The ship is returned to normal flight from the ensuing dive or glide, in a direction about 180 degrees from that at the start of the evolution.

A split S consists of a half snap roll, followed by a pull out to normal flight (thus obtaining a 180-degree change in direction accompanied by a loss of altitude).

The purpose of a chandelle is to gain altitude at the same time that the direction of flight is changed. The airplane is put into an abrupt climbing turn to approximately a stall, the momentum of the ship being used to obtain a fast climb.

The Immelman turn is made by completing the first half of a normal loop and then from the inverted position a "he top of the loop, by half rolling the ship to the level position.

Animal Models Cast and Colored in One Process

Making a plaster mold of a lizard which will be used in casting a model of the animal. The ke in both form and coloring



Lifelike models of birds, reptiles and animals are seen above. They were cast by a process that colors them while they are in mold.



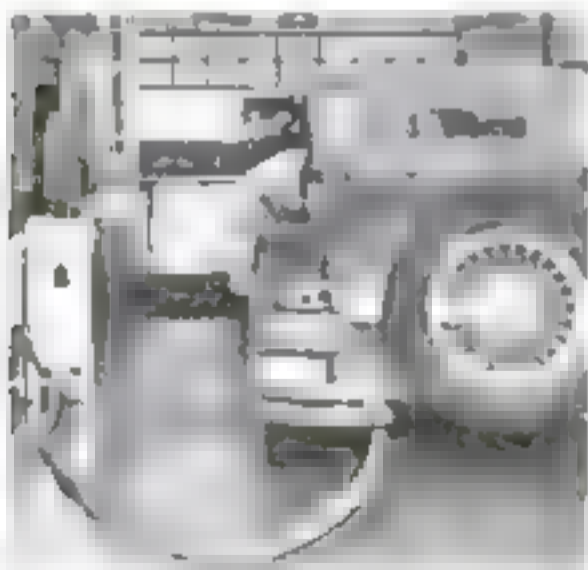
A mold, made from a living lizard, is shown being tested for natural coloring.

PERFECT as to form and color, models of living creatures are now produced by a process developed by Leon F. Walters, taxidermist of the Field Museum of Natural History, Chicago. With the old method, molds were made and poured, and the casts were then hand-painted as realistically as possible. But inevitably many characteristic markings were lost. By the

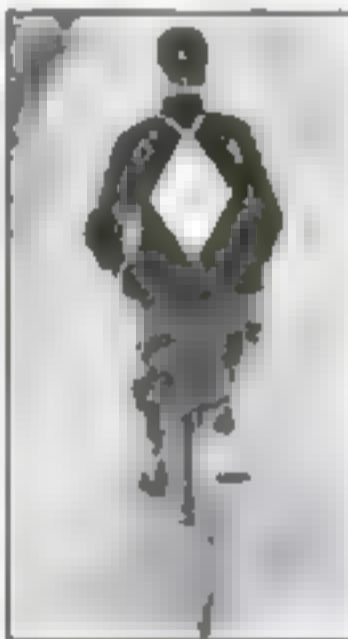
new method, molds, made in the usual way, are divided in half and the inside painted with a liquid preparation colored realistically. When the halves of the mold are reunited and the cast poured, the result is a model of the original, perfectly formed and strikingly colored so that no further work is required to give the model a lifelike appearance.

DEADLY MONOXIDE GAS PIPED OUT OF GARAGE

DANGER of carbon monoxide poisoning is eliminated in New York City garage by a blower system with junction boxes at convenient points. To these boxes are attached lengths of flexible hose which are connected to the exhaust pipe of the automobile being tested or repaired. In this way the noxious fumes have no chance to escape into the workroom.



Through hose fastened to car's exhaust pipe, monoxide fumes are carried to containers.



TAIL LIGHTS PROTECT HIKERS AND BIKERS

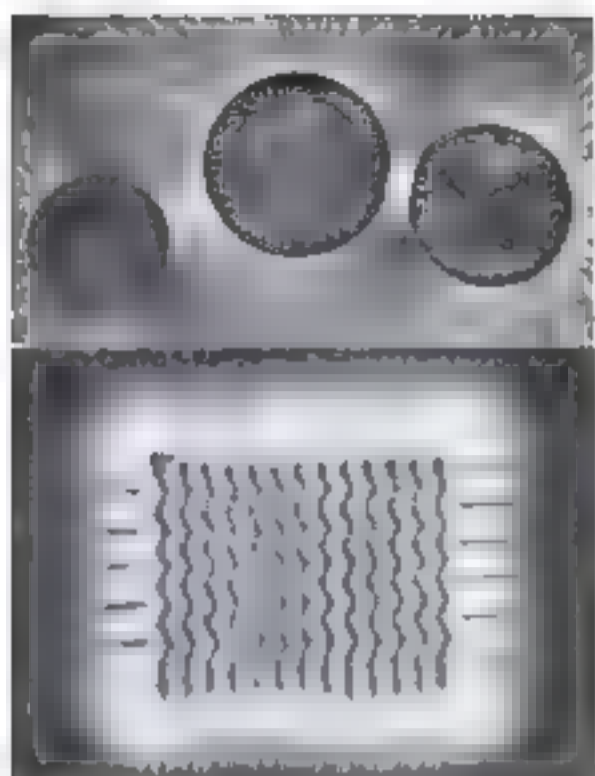
Hikers and cyclists in England are now protected after dark by an ingenious tail light. Worn on the back, it consists of a piece of white rubber with a red lens in the center which shines like an auto's headlight.

"WIRE" FENCE GROWS WILD

BARRIED wire" fences that do not have to be renewed or repaired are found in Arizona. They are formed of rows of transplanted *Opuntia* cacti, whose spines are as deadly as the barbs on wire fencing. This cactus grows plentifully in the country about Tucson and to secure a permanent fence, it is merely dug up and set out along the boundary line. The plant is now being cultivated for sale, since its commercial value has been discovered. Dozens of acres of land around Tucson have been converted into fence nurseries.



This living "barbed wire" fence consists of cactus that grows wild in Arizona. Set out by bands of the plant forms a high fence.



UNUSUAL PHOTOS MADE IN HIGH-VOLTAGE GLOW

BY PASSING high voltage current through familiar objects, remarkable photographs of them have been taken in Germany. Coins, necklaces, and belt clasps, used in the experiment, glowed with fantastic radiance and the material was easily photographed in a darkened room. Voltages ranging from 100,000 to 150,000 were used in making the pictures but the objects were not damaged.

OUR "WONDERLAND" IS AGAIN AT CHICAGO FAIR

POPULAR SCIENCE MONTHLY'S Mechanical Wonderland, the exhibit that thrilled thousands of World's Fair visitors last year, is back in Chicago and is again running at the Fair. Hence those who missed our exhibit last summer as well as those who saw it and would like to see it again now have a chance to witness and enjoy this amazing demonstration. The exhibit is once more installed in the Pavilion of Industrial Engineering on the second floor of the General Exhibits Building, next to the Hall of Science.

New Radio Pen Reproduces Pictures Put on the Air

Picture pen reproduces pictures put on the air.



BRIEF AND CONCISE

development by T. A. E. New York radio.

home use of commercial high-speed facsimile apparatus and is housed in a metal cabinet no larger than a typewriter. An electrical pen traces ink pictures broadcast from the transmitting studio upon a moving paper strip four inches wide requiring about two and a half minutes to complete a sketch. Legible words in quarter-inch letters may also be received at the rate of about forty words a minute. Since words or pictures, and sound, may be broadcast and received simultaneously



on adjacent channels, a food manufacturer could provide printed recipes with his program; a travel lecturer could map an auto tour while describing it, or drawings to be colored could be transmitted.

FINGERPRINT OUTFIT FOR HOME DETECTIVE

WORK as an amateur detective is made more thrilling by means of a fingerprinting outfit recently produced. With it the manufacturer claims anyone can detect and record fingerprints in a professional manner. The method used is patterned closely after that adopted by police departments and the results are said to be highly satisfactory. The set consists of ink, roller, and impression glass for recording the prints and of the essential black and white powders and brushes that are used in developing the prints. Record sheets are also included.



Ink, roller, paper, and powders needed in developing and reproducing fingerprints are contained in this amateur outfit.



NEW FLASH LIGHT IS ADJUSTABLE

A FLEXIBLE flash light, just placed on the market, may be stood on end to serve as a trouble lamp, with the light directed just where it is needed. Two adjustable side arms carry current to the bulb in the rotating head, which may be tilted to any desired angle or retracted when the device is to be used as a conventional hand flash light. Photographs above illustrate it in two positions and suggest the light's convenient flexibility.

MASKED CORPS TO SAVE SEWER VICTIMS

RESCUE of workers overcome by poisonous gases in the sewers and other underground passages of Düsseldorf, Germany, has been greatly simplified by the organization of a masked life-saving corps. Wearing oxygen masks and carrying electric

torches, the life savers are unaffected by the gas generated by the wastes flowing through the underground tunnels. The corps is able to perform an equally valuable service for the workers on the city's gas mains.



SUMMER HAT WEIGHS OUNCE AND A HALF

MOLDED from fiber, a new hot-weather hat, weighing only one and one-half ounces, has recently been invented. Resembling in appearance the pith helmet which is widely worn in tropical regions, the hat is prevented, by an adjustable inner band, from touching the head, thus permitting air to circulate beneath the crown. The hat is made in only one size but by means of the inner band it can be adjusted to fit any size head. The band holding it securely even in high wind.



NEW GRAPHITE GUN FOR USE IN YOUR HOME

ANYONE may enjoy the advantages of using graphite as a lubricant, with the introduction of the hand gun illustrated above for convenience in applying it in the home and garage. After a curved spout is opened, an air-borne spray of graphite is forced out by squeezing the rubber bulb. The nozzle can be adjusted for a fine or heavy spray.

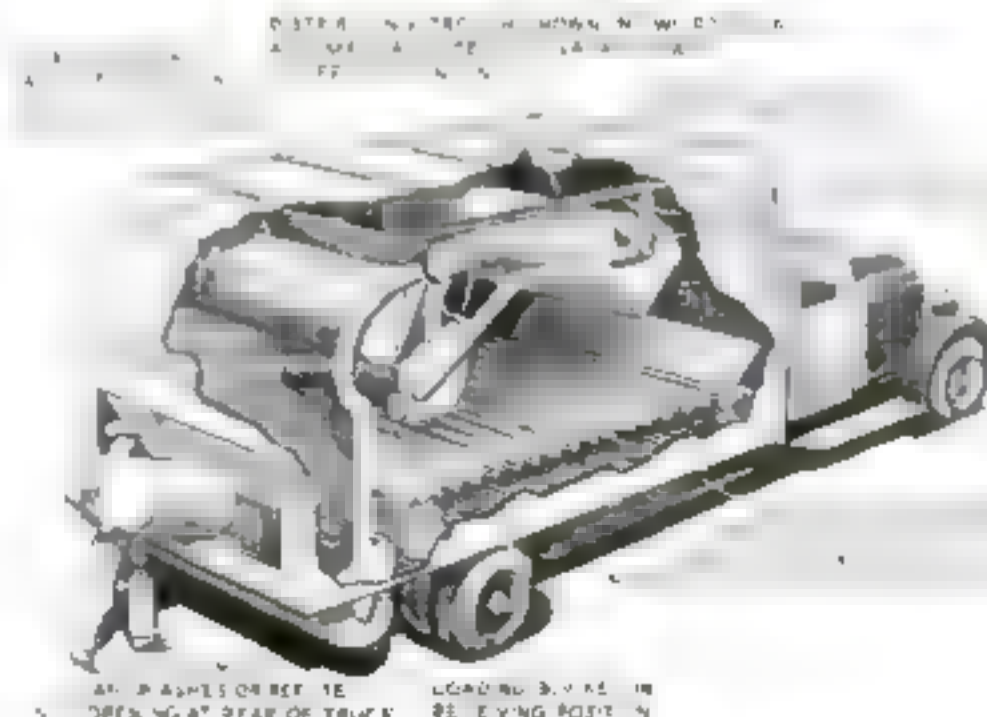
OUR MECHANICAL SHOW IS AGAIN AT WORLD'S FAIR

POPULAR SCIENCE MONTHLY invites you to visit its Mechanical Wonderland which once more is on exhibition at the World's Fair in Chicago. The display attracted wide attention last summer. If you missed it, you will be glad of this chance to see it. It is in the General Exhibits Building adjoining the Hall of Science.

MOVING FLOOR UNLOADS NEW TRUCK

GARBAGE is disposed of in a swift and sanitary manner by means of a new truck originated by a Stamford, Conn., inventor. An enclosed body prevents refuse, loaded through an opening at the rear, from dropping off while the truck is in motion. In unloading, a push button signals the driver to start the automatic mechanism that moves the garbage to an inner distributing trough in the truck and is ready for another load, all within twenty seconds. To unload the truck, the driver touches another control and an endless moving floor ejects the contents. According to the inventor, Henry C. Lima, who has

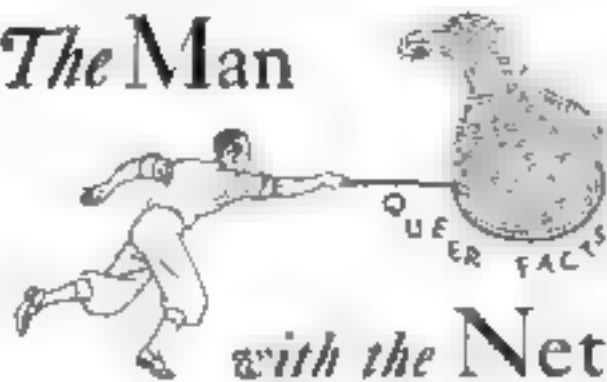
built refuse trucks now in use in many large cities, this unloading method replaces the use of a tilting body and greatly speeds the removal of a city's garbage.



Above, garbage truck that is loaded by an automatic mechanism and unloaded by means of its moving floor. At left, cutaway view of the truck showing how the mechanism works inside its enclosed body.

AT PAGES 108-110
OPENING AT REAR OF TRUCK
LOADING BODY IN
RELEVANT POSITION

The Man



with the Net

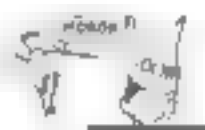
FLY'S WINGS are mixed with rag fibers in making a high-quality correspondence paper.

• • •

WE MIGHT live for 1,900 years if we could keep our blood temperature at forty-five degrees Fahrenheit, laboratory tests show.

• • •

ELECTRONS cost \$10,000 a pound when we pay five cents a kilowatt-hour for current.



A HUMMINGBIRD has proportionately more brains than a man. Its brain is a twelfth its body weight; a man's is a thirty-fifth.

• • •

AS MUCH static electricity accumulates in one New York skyscraper that a neon lamp can be lit by applying wires to a doorknob.

• • •

SPIDERS stopped a courthouse clock in Indiana by spinning webs inside the works.



UNDERWATER spectacles to aid swimmers have been invented in California.

• • •

CHANNED meat is being injected into the veins of French patients to cure infection.

• • •

WHO doesn't madden a bull because a bull can't see red. Tests have shown the animals are color-blind, so red looks like black.

• • •

FISH with hands live in the Sargasso Sea. Possessing fins formed like gripping hands, they cling to the seaweed.



GRAPESKIN now yield oils to produce synthetic violet and rose perfumes.

• • •

THE word "sablot" is a copyright trademark. It was coined fifty years ago as the name of compressed chemical products.

• • •

THE CATERPILLAR of the puss moth spits a stream of poison liquid when it fights.

• • •

COMPRESSED AIR is used in South African fields to blow diamonds out of crannies.



Greenhouse Comes in Sections

GREENHOUSES that can be assembled as easily as sectional bookcases have just been developed in England. Only eighteen inches high and about 25 long, the sections can be arranged in any manner desired by the gardener, giving him wide flexibility in laying out his garden. The light weight of the sections, which are constructed of glass over metal framework, permits them to be lifted easily and a metal loop at the top further facilitates handling. When not needed, the sections can be stored away in a comparatively restricted space. The picture at the right shows one of the sections being lifted out of line to permit inspection of its contents.



DYNAMITE BLAST KILLS ANT COLONIES

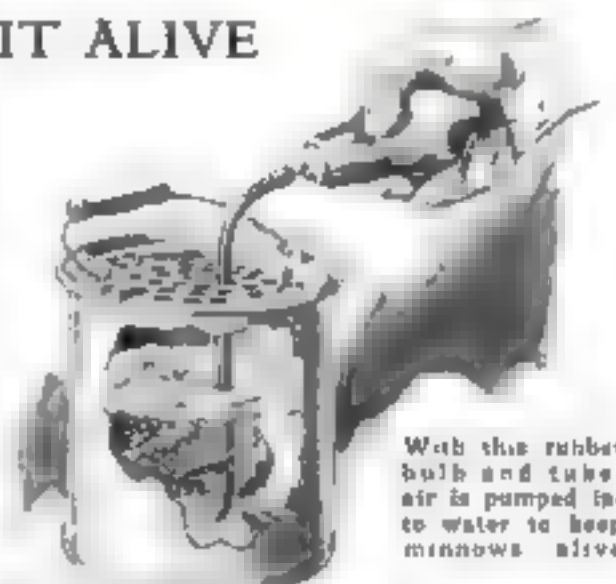


Dynamite is placed in the main cavity in an ant hill and the colony killed by blast.

SETTING off charges of dynamite buried in the ground is a new method being used to exterminate ant colonies. Formerly poison gas was used but this method failed to destroy the eggs. In using dynamite, a four-inch hole is bored in to the sub-surface where the ants store their food. A charge of dynamite sufficient to shatter the underground passages is exploded and the ants that escape the concussion are killed by the fumes given off by the blast. In this way the eggs also are destroyed. The process is inexpensive and speeds extermination of the pests.

AIR PUMP KEEPS BAIT ALIVE

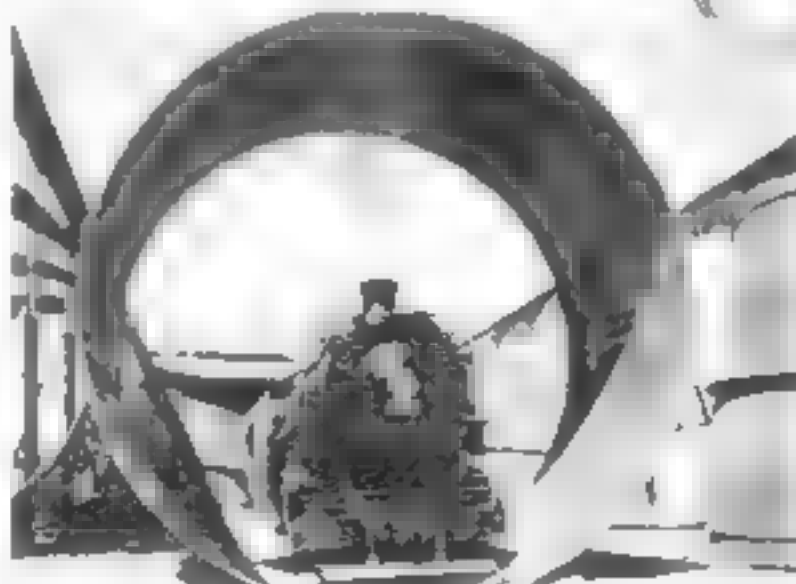
FISHERMEN need no longer be annoyed by having their minnows die in the bait bucket. An air pump consisting of a rubber bulb and a tube has just been invented and is intended for use in aerating the water in the minnow's container. The inventor is a St. Paul physician and surgeon who studied the problem of easily renewing the supply of oxygen in the water in the bait bucket. With his invention a supply of air can be pumped into the water whenever needed.



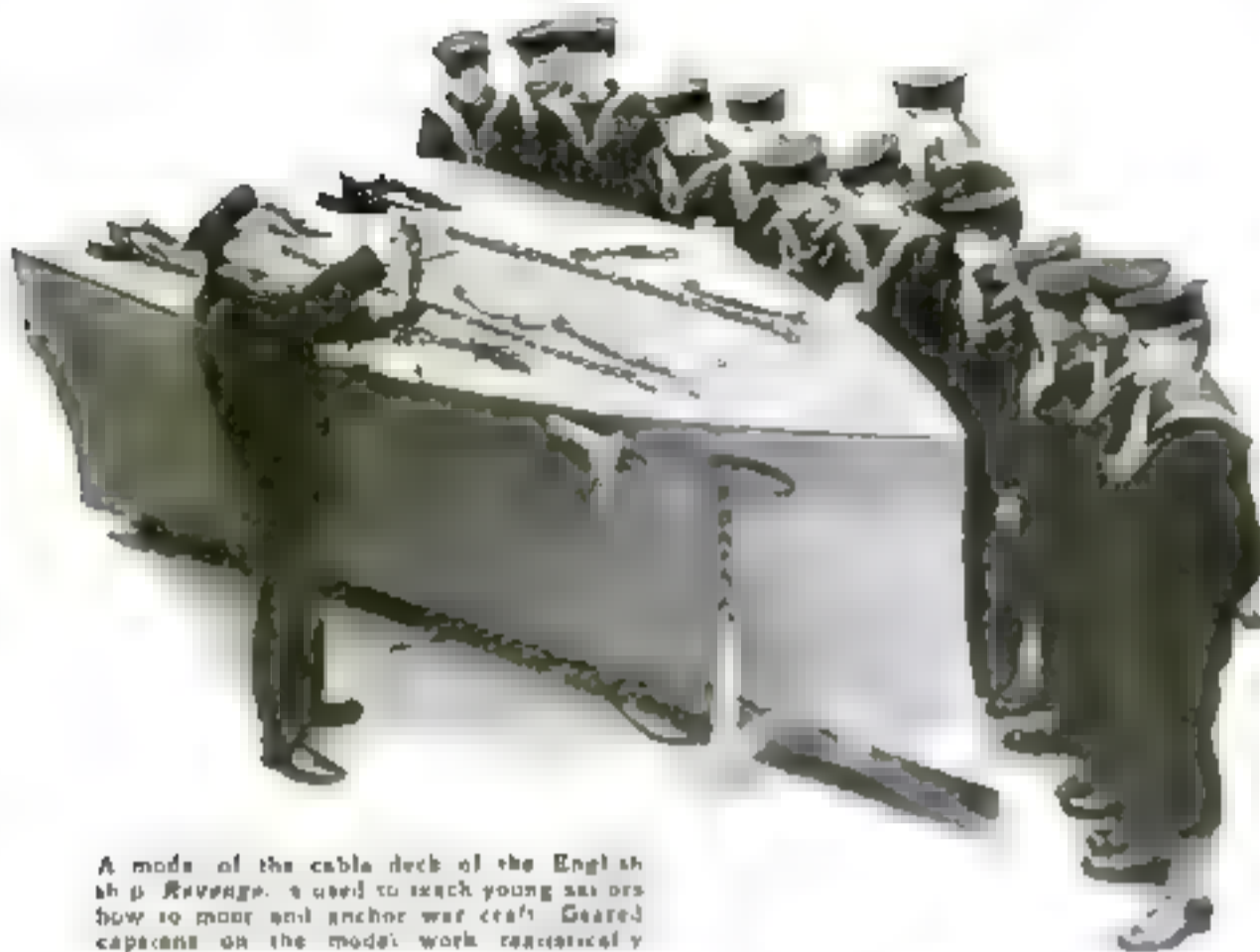
With this rubber bulb and tube air is pumped into water to keep minnows alive.

WATER PIPE BIG AS LOCOMOTIVE

BIG enough to hold a locomotive, with room to spare, sections of the penstock pipes for the Boulder Dam hydro-electric development are now being constructed. The penstocks will control the flow of water with which electricity will be generated. The pipes are thirty feet in diameter six inches larger than the Holland Tunnel under the Hudson River at New York.



Pipes the size of this, big enough for a locomotive to run through, will control the flow of water at Boulder Dam.



A model of the cable deck of the English ship *Revenge*, is used to teach young sailors how to moor and anchor war craft. Gearing capstans on the model work realistically.

SHIP MOORING TAUGHT ON DECK MODEL

WITH a one-eighth size model of the cable deck of H.M.S. *Revenge*, future sailors in the British fleet are taught all there is to know about mooring and unmooring fighting ships. The model, which was recently acquired by the naval train-

ing station at Hamble, England, has geared capstans which can be operated realistically for the purpose of showing the young sailors exactly how capstans are worked on the big ships. In this way many of their training errors received without once leaving shore.

STEEL WIRE REPRODUCES VOICE IN SCREEN TEST

USING a steel wire instead of film or phonograph records, a device that can reproduce sound as soon as it has been recorded is now being used in Hollywood, Calif., to test the voices of screen players. During recording, the moving wire passes between electromagnets that magnetize it at points determined by the fluctuations of the voice. When the wire is run through pick-up the sound is reproduced.



With this apparatus, words recorded on a moving steel wire can be immediately reproduced.



A hub cap for wire automobile wheels has been perfected by Ralph Sickles, a Toledo, Ohio, inventor. The cap contains a red center, encircled by small colored jewels. It is lighted by an interior bulb. Current for the bulb is carried to a roller affixed to the brake drum, then to a copper band encircling the drum, and finally by a wire threaded between the spokes to the bulb. The purpose is to aid drivers in judging distance between cars when meeting or overtaking another vehicle.

ILLUMINATED HUB CAP NEW AID FOR DRIVERS

AN ILLUMINATED hub cap for wire automobile wheels has been perfected by Ralph Sickles, a Toledo, Ohio, inventor. The cap contains a red center, encircled by small colored jewels. It is lighted by an interior bulb. Current for the bulb is carried to a roller affixed to the brake drum, then to a copper band encircling the drum, and finally by a wire threaded between the spokes to the bulb. The purpose is to aid drivers in judging distance between cars when meeting or overtaking another vehicle.

SPRING WINDER FOR HOME WORKSHOP

SPRINGS can be wound by hand in any home workshop with a newly invented tool. It consists of a steel block, which is clamped in the bench vise, and a mandrel turned by a hand shaft. Wire for the spring is passed through brass washers attached to the block and either to the mandrel or the crank. Pitch of the spring being wound is controlled by an adjustable shaft set in the block.



Springs can be wound in home workshop with this steel block and mandrel. C one-up of block at left.



NEW TEST FOR GOLF GREENS

THROUGH a newly devised test, a golf course greenskeeper can determine whether his putting greens are likely to become too hard, or too soft, under playing conditions. A sample of soil is molded into a triangular bar and allowed to dry out. It is then laid upon two end supports and a pad hung from its middle. Sand is poured into the pad, as at left, until the bar snaps. Soil that does not crumple easily, but is not too resistant in this test is most suitable for greens.

STUNTS WITH STRINGS AND MAGNET SHOW

How METEORS and Comets Travel



WHEN imaginative writers predict future trips to Mars or the moon in rocket planes, they ignore the biggest hazard of this imaginary journey. The moment such a rocket left the protecting cushion of the earth's atmosphere, it would be exposed to the incessant bombardment of meteors.

Many millions of these fragments of interplanetary debris are burned up every day by the terrific heat generated by friction with the earth's atmosphere. When we see this happen as we may frequently do, especially in August, we call the glowing streak across the sky a shooting star.

You can hardly be out of doors on any clear summer evening without seeing one or more of these intruders from outer space burned up. When the great meteoric swarms cross the earth's orbit thousands of meteorites are visible in an hour.

It is a surprising fact that the meteors



WHY WE SEE METEOR SWARMS
Three pieces of cardboard, set at different angles as in the picture above, show how the earth's orbit crosses the paths of our two largest meteor swarms. Note that the orbit of the August meteors crosses the earth's orbit at a right angle. At left, a variation showing that the orbit of the November meteors extends beyond Uranus, the meteors requiring about thirty-three years to move once around its vast orbit.

By GAYLORD JOHNSON



that invade our atmosphere are discharged through space along parallel lines, just as bullets are from a Gatling gun of the old type.

Someone who has been fortunate enough to see a real meteor shower may protest that the meteors all diverged from a single point and rayed out starlike.

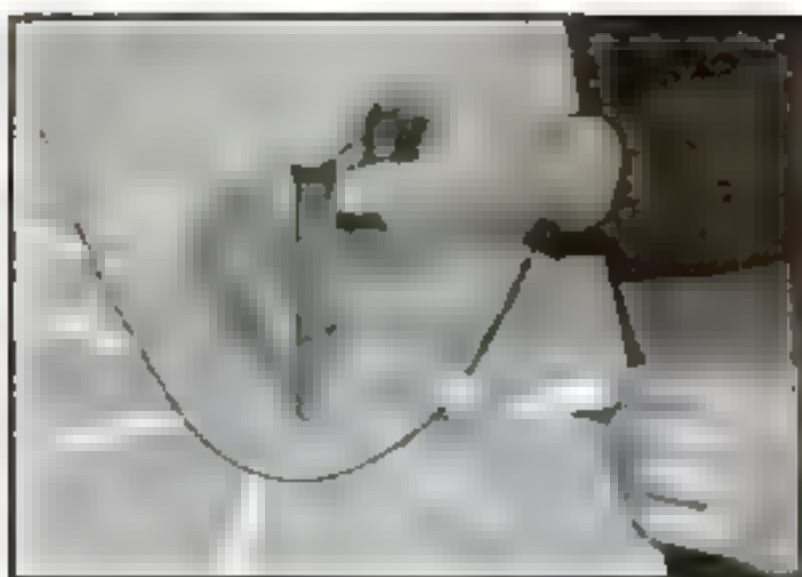
However, this apparent contradiction is easily explained by a glance at the illustration at the bottom of this page. The observer, looking along the inside of the tubular arrangement of parallel strings (swarm), the constellation of Leo sees the cords diverging like the spokes of a wheel. Imagine meteor trails a pair of strings and you will see why each meteor swarm appears to fan out from a single point, which is called the swarm's radiant.

The strings, however, represent only the relatively tiny part of a meteor swarm's orbit which cuts through our earth's atmosphere. This is the only part we can see because the meteorites are invisible until they enter our atmosphere and begin to burn with the heat.

By noting carefully the radiant point among the stars from which each meteor seems to come, it is possible to trace that swarm far out



METEORS MOVE IN PARALLEL LINES. At left, parallel strings are attached to a map of the star group Leo. They represent the paths of the November meteors. When you look along the inside of the strings, they will seem to diverge as the lines do in the circle. This shows why they appear to come from one point.



into space and plot its probable orbit.

The swarm of meteors known as the Leonids because they seem to radiate from a point in the constellation Leo, have been responsible for the most awe-inspiring displays of natural fire-works in history. These displays occurred regularly about every 33 years. There was a magnificent shower in 1799, and it was repeated in 1833 and 1866. In 1899, however the number of meteors in the shower was disappointing, and this was also true in 1937. Some astronomers believe that the Leonid swarm now passes farther away from the earth's orbit.

That the Leonid meteors have not wholly vanished you can easily prove by watching for them on the nights of November 13, 14, and 15. If you continue your vigil between midnight and morning you will see many more than you see earlier in the night. This is also true when you watch for the Perseids, which are due in greatest numbers from August 9 to 11.

This increase in the number of meteors after midnight sounds mysterious, but the explanation is quite simple, and is made plain by the experiment illustrated with the parallel strings and small globe.

First get into your mind a mental picture of a man running rapidly in a shower of rain. Even if the rain is falling vertically the running man's chest gets wetter than his back, because of the continuous advance of his body to meet the drops.

Now replace the running man by the

MYSTERY OF A COMET'S TAIL The picture at upper left shows why the tail of a comet always points away from the sun. This is due to the repulsion of the matter in the tail by the sun's light. If a compass is moved in a comet's orbit around the north pole of a magnet the needle will point away from the magnet; the north pole of the compass needle being repelled by the north pole of the magnet. At upper right a photograph made at the Lick Observatory of a comet shooting through the skies. Note the extended tail of thin material

earth traveling in its orbit and the falling shower of rain by a swarm of diving meteors. It will then be obvious that the forward hemisphere of our world is constantly pelted with more meteors than the rear half.

In spite of the great frequency of occasional shooting stars and the comparative frequency of quite remarkable meteor swarms, it is an amazing fact that almost all that is known about their nature and orbits has been learned during the past seventy years.

The story of the growth of this knowledge of meteors deals almost entirely with a few enthusiastic amateurs. W. F. Denning, an English amateur observer found the study of meteors so fascinating that he became the world's outstanding

authority on meteors. When he began his observations, only a few swarms and their radiant points were known. In a few years, he found and recorded the radiants for over 700 swarms.

To any one interested in meteor observation, the first requisite is an intimate knowledge of the principal constellations. This is necessary in order to find the radiant points of the various swarms.

A good star atlas, or set of star maps, will give detailed information and enable the enthusiast to locate the various radiants as given in the following table of the outstanding swarms. The name of the constellation where the radiant appears is apparent from the name of the shower, as for instance the Lyrids in the constellation Lyra and the Perseids in Perseus, etc.

Name Shower	Best Observation	Constellation	Time of maximum	Duration in Days
Lyrids	April 20-21	Lyra	Apr. 19	4
Perseids	Aug. 11-13	Perseus	Aug. 11	8
Orionids	Nov. 17-18	Orion	Nov. 17	5
Leonids	Nov. 13-15	Leo	Nov. 13	10
Andromedids	Nov. 1-2	Andromeda	Nov. 1	2
Geminids	Dec. 7-8	Gemini	Dec. 7	14

In observing meteors, the most important thing is to note accurately the point among the stars where the meteor first appeared and the point where it disappeared. These points should then be marked upon a sketch of the constellation which includes the radiant of the shower you are observing. The line joining these points will pass through the radiant.

After a few of these meteor directions have been plotted, the point where the extended meteor lines all come together will indicate the radiant.

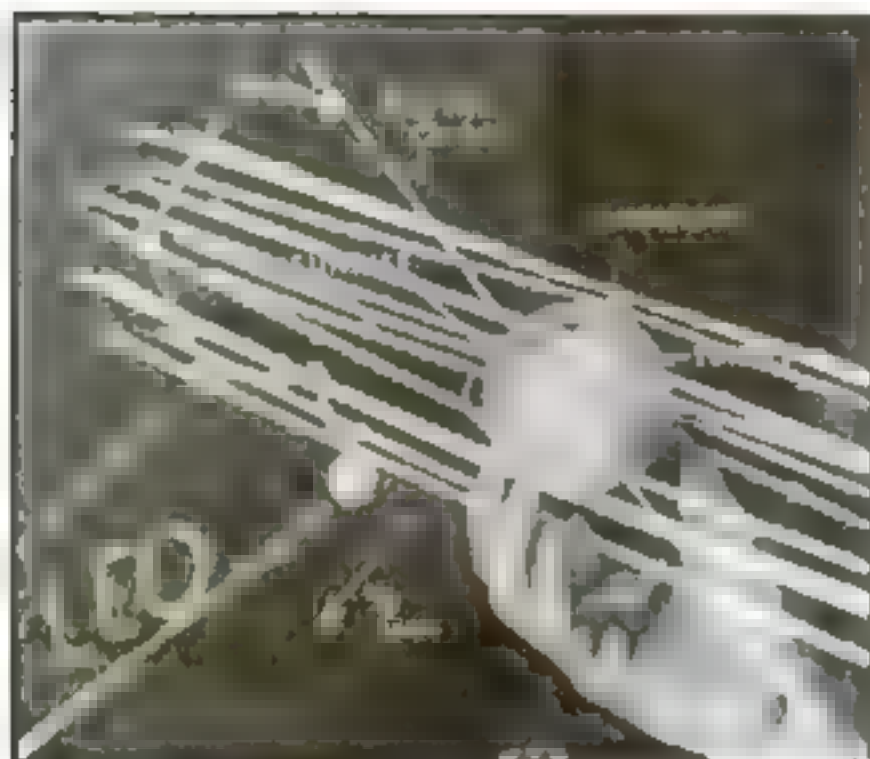
The tendency of meteor swarms to follow long, narrow elliptical paths through space at once leads us to wonder how they are related to recurrent comets which do the same. It has now been found that the relationship is close, as meteors are the shattered remains of comets. This is shown by the fact that when a regularly returning comet fails to reappear at its expected time the earth generally passes through a new swarm of meteors.

Most people think of a comet as speeding through space with its tail always streaming out behind, like the smoke from a mile-a-minute locomotive. Frequently this mental picture is untrue, as in one part of a comet's orbit, its tail precedes instead of following it like the beam of the (Continued on page 106)



WHY METEORS ARE MORE FREQUENT AFTER MIDNIGHT

In watching for a meteor display the best hours are from midnight to dawn. The reason for this is made clear in the illustrations at left and above. Running in the rain, a man's chest will become wetter than his back even though the rain is falling vertically. In the same way, the earth, revolving to the east is running toward the meteor swarm after midnight and away from it earlier in the night.





Reprinted from *Life* Magazine

WWW.MAGNETICFIELD.COM PLANNING

A YEAR in the company with
 me, you will miss the
 Creative Construction of this

Two girls were caught in a crevice. I was flushed first and to get out of the predicament, my only school young single son with dependent nervous (I guess) constitution was the person to use. He was a bookworm. I was over the wall and over the fence and the country.

[illegible]

On April 2, 1954, less than three weeks after the C. C. B. had been organized, the first camp was established in George Washington National Forest near Lantry, Va. From work there and various other sprang up in the period between 1954 and the summer of 1955, many of these included Chocoma and the forests of Annapolis, Maryland. There were 100 of the camps at the time 2,500 men were engaged.

By
Robert
E.
Martin



Many of the men in the CTC camp is married and of vital importance to the nation. Above they are seen getting a forest fire. At least a dozen men are working on the fire.



Before being sent to an employment and the men were examined at a recruiting office as seen above. At left CCC recruits receiving clothing provided by the government.

In the large camps, the task of housing the men was a big one, as the picture below shows. Rooms were furnished by the Government and the men, for the most part, had excellent accommodations.

10,000 EROSION DAMS TO

These men were among the Americans who were sent to the United States to help in the fight against erosion.

The United States government has been very successful in its fight against erosion. It has built 10,000 erosion dams to help in the fight.

American men were sent to the United States to help in the fight against erosion. They were sent to the United States to help in the fight against erosion.

The United States government has been very successful in its fight against erosion. It has built 10,000 erosion dams to help in the fight against erosion.

The United States government has been very successful in its fight against erosion. It has built 10,000 erosion dams to help in the fight against erosion. The United States government has been very successful in its fight against erosion.

The United States government has been very successful in its fight against erosion. It has built 10,000 erosion dams to help in the fight against erosion.



CCC workers labored only forty hours a week which left plenty of time for recreation. The most popular were the theatrical performances that the men staged, recruiting unexpected talent, as photo shows, from among their ranks.

EXTERMINATING PESTS

Work was done every hours a week, saving the forest from the ravages of insects.

It was a good job, every week, that the CCC men did, because the forest was saved from the ravages of insects after the burning.

In the woods, the men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

The men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

The men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

The men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

The men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

The men were working to save the forest from the ravages of insects. They were working to save the forest from the ravages of insects.

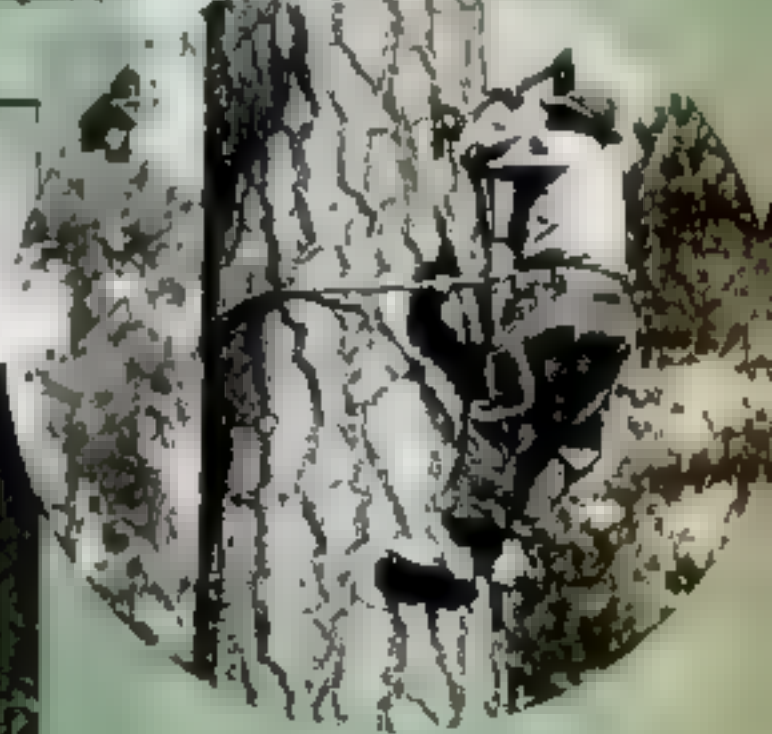
Below is a view of the CCC workers constructing an erosion curb for the purpose of saving the soil that otherwise would be washed away. This was one phase of their conservation labors.



Before work began, the men were organized by drills as shown above. In this way, workdays were prepared for hard work.



Part of the men's recreation was training pets. Above, a male deer, fawn, the mascot of one outfit. At left, CCC worker using a telephone spray pump to kill insect pests.



As part of the forest fire fighting work, telephone wires were strung through the trees as above. By this means warning could be given and assistance rushed to the threatened area. Thus fire losses were seventeen percent less than in other years.



It was necessary at times to cut down trees to seal off fires for water can put them out, above shown a fire slain through and on the point of falling. At left, worker piling up bags of cement ready for the mixer.

It was frequently at times
to cut down trees to clear
ing sides for auto camps.
I should say, above all
a fire down through and on
the point of falling. At left
worker pointing: bags of
cotton wool, in the inner

1. The first part of the document is a letter from the President of the United States to the Secretary of the Navy, dated 18th March 1899. The letter is addressed to the Secretary of the Navy, Washington, D.C. The letter is signed by the President of the United States, William McKinley. The letter is dated 18th March 1899. The letter is addressed to the Secretary of the Navy, Washington, D.C. The letter is signed by the President of the United States, William McKinley. The letter is dated 18th March 1899.

[illegible]

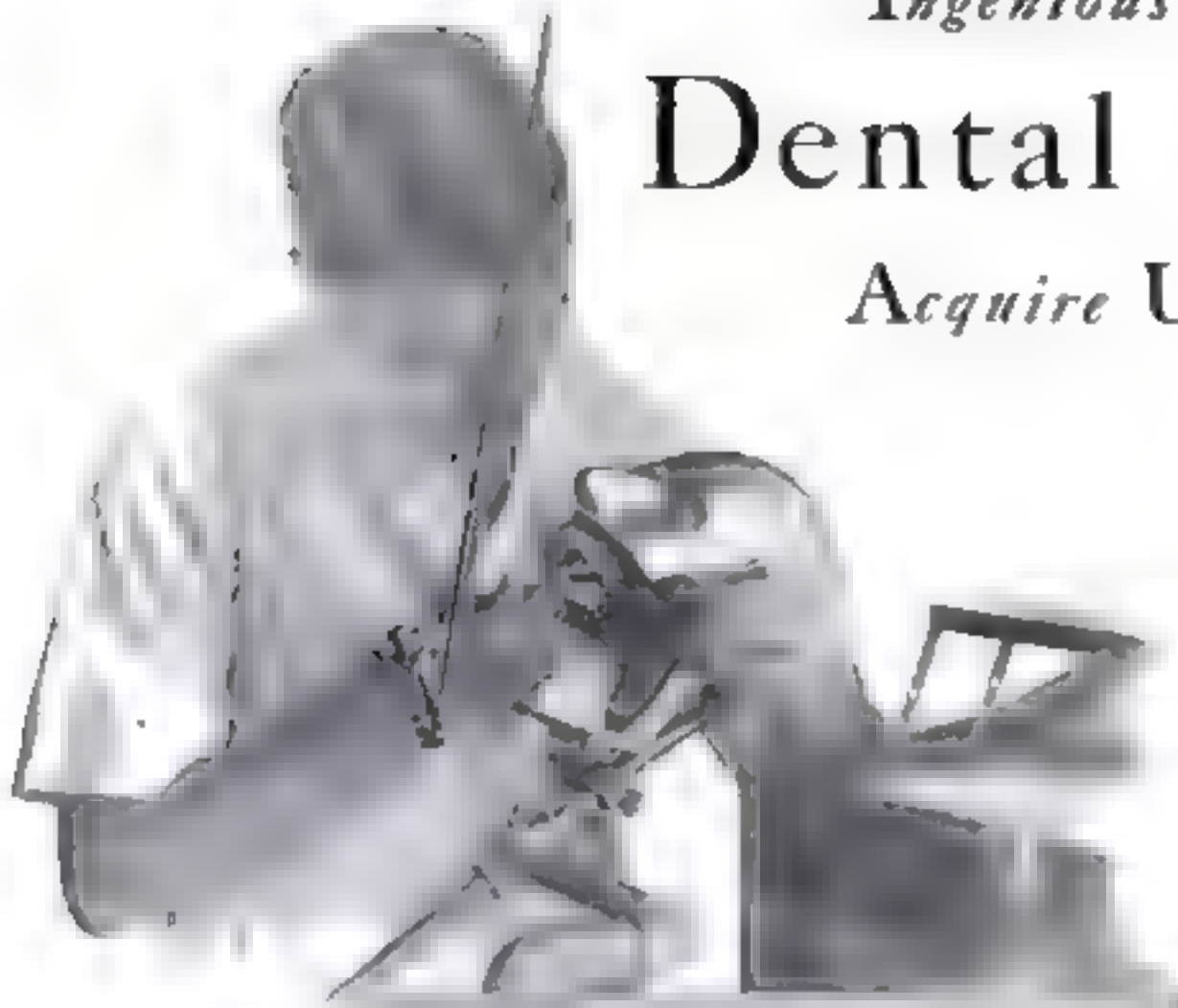
For some agencies, creating a new or enhanced supply of new talent with the right mix of skills can be a challenge. In the U.S., for example, the Department of Defense has

The New York Times was the first newspaper to report on the gas chamber. It was a brief article about the execution of Julius and Ethel Rosenberg. The article was written by Walter Winchell, who was a well-known journalist at the time. He wrote that the Rosenbergs were "the first Americans to be executed by electric chair since World War II." This was a significant statement because it highlighted the fact that the Rosenbergs were being executed for peacetime crimes.

Conserving the forest property was part of the task assigned the CCC. Left: men are in cutting a jet in a big tree. Under the direction of an expert they cut away the rotten wood. Filled the hole with cement and bound up the wound.



Ingenious Tests Help Dental Students Acquire Unusual Skill



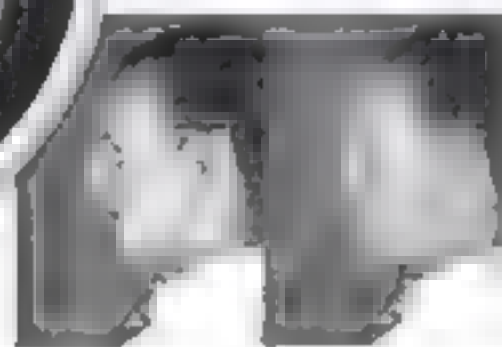
Above dental student using a dummy with removable teeth to practice his skill with drill and other instruments. Students are required to make false teeth for the dummy. At right—model carved in wax by freshmen dentists as a test of their manual dexterity. The model is such a good index of future success at their work



WHEN a freshman enters the School of Dentistry at the University of Southern California, one of his first tasks is to carve, with a knife as his only tool, a wax model of some object he has seen. The miniatures are preserved in a "museum" by Dr. William P. Harrison, professor of dental anatomy and technique who has found from students' later records that the odd test gives a surprisingly accurate index of a student's natural manual dexterity. Other necessary attributes of a successful dentist are developed by methods that might seem odd to a layman. Dummies with removable teeth serve as patients for practice with the drill and other instruments. An aluminum mannikin, fitted with false teeth by the students, must be made to chew naturally. The strength of the human bite is measured with special scales, and students make plaster casts of each other's features to learn how the teeth affect the expression, since a good dentist must always be solicitous of his patient's appearance. A camera is also used to aid in this study. Tiny stars of court plaster are affixed with tweezers to key points of a student's face and he is photographed against a measuring scale. The stars help in reducing the photograph to a geometrical diagram of triangles and four-sided figures, enabling the student to see how his expression is influenced by his teeth, and how he would fit himself with a new set.



Using a photostatic camera a picture of patient's face is made against a measuring scale. Stars, as shown on plaster cast, have been affixed. They help reduce photo to a diagram of triangles



Above using special scales to measure the strength of the human bite. At left—two of the expression pictures made with the photostatic camera. Note stars marking the key points and through which lines are drawn to give the geometrical four-sided figures that are used in determining the influence of teeth on the contour of the face

LAND CATAPULT LAUNCHES AMPHIBIAN PLANE

For the first time in the history of aviation, an amphibian airplane has been launched successfully by a land catapult. The feat was achieved by the Royal Aircraft establishment at Farnborough, England, where a plane was shot into the air. The catapult used, first of its kind ever constructed, is designed to enable planes to take off from restricted airport areas. As described in this magazine at the time of its installation (P. S. M., Aug. '33, p. 43), compressed-air tanks provide the power.



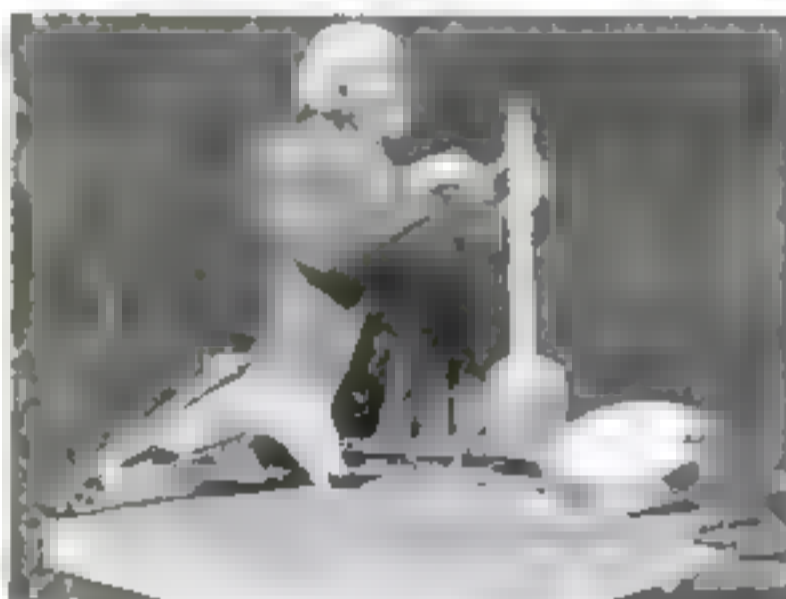
For the first time in aviation history, this huge catapult, worked by compressed air, successfully launched a big amphibian plane recently from the Royal Aircraft grounds.



PUT TAGS ON BATS TO LEARN FLYING HABITS

Bands are being placed on bats at the Berlin, Germany, Zoo to help scientists study their flying habits. A tiny aluminum band affixed to one wing, as shown above, bears a number and the word Berlin. The bats are released and from reports of their later capture it is expected accurate charts of their flying habits can be compiled.

JAW OF MULE IS "SAMSON'S" BANJO



CREATING strange musical instruments is the hobby of F. B. Currier, Goose Creek, Texas, craftsman who is shown at left applying the finishing touches to a violinello that he made from a one-gallon glass jug and a cedar post. Melted aluminum pots and pans furnished the material for the banjo lying beside it. At the left is a banjo which Currier named the "Samsonette." It is made of the jaw of a mule, with a cigar-box neck.

BARREL HOUSE READY FOR OCCUPANTS

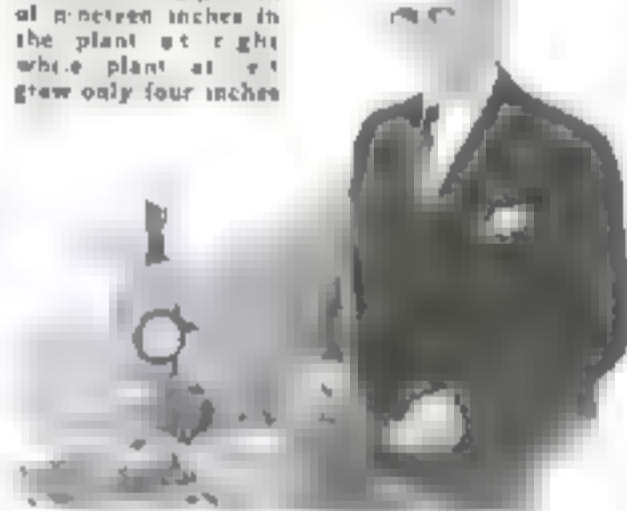


Above, a model of the barrel house showing how it is supported by the hoops that form its walls and roof. Right, exterior view of the completed barrel house ready for occupancy on its Düsseldorf, Germany, site.

A house in which steel hoops take the place of joists, rafters and studding, has just been completed at Düsseldorf, Germany. According to the architect who originated the odd design, it provides strength and stability at reduced cost by eliminating the need for thick outer walls. The new style of construction, he asserts, is especially applicable in regions subject to earthquakes. Tests upon models preceded the construction of the first full-sized house on which work began a few weeks ago and which is ready for occupancy (P. S. M., June '34, p. 20).



Ultra short radio waves forced a growth of nineteen inches in the plant at right while plant at left grew only four inches.



PLANT GROWTH SPEEDED BY ULTRA SHORT WAVES

Ultra-short radio waves produced startling results in the laboratory of a New York electrical research engineer, J. Henry Hallberg. Two bulbs were planted in separate pots. One was subjected to high-frequency radio waves from a specially designed apparatus. While the untreated bulb produced a four-inch sprout, the treated plant grew nineteen inches.

FIRST-AID KIT IN HIGHWAY SIGNPOST

Signposts recently erected on British highways not only tell tourists their directions, but provide them with first aid as well. In the event of an accident on the highway any passing motorist or pedestrian may help himself from a kit of medical materials enclosed in a waterproof case of metal that is attached to the eye-level post. The case is opened with a key that is obtained by breaking a pane of glass, as in the customary method of turning in a fire alarm. In this way anyone not in actual need of the contents is discouraged from tampering with the box and removing contents.

A29
DORSET
LONDON



First aid kit attached to signpost on highway can be used in an emergency. Breaking a glass gives access to the key.



NEW FOOT PADDLES MAY MAKE SWIMMING EASIER

EASIER swimming is said to be possible with a set of foot-paddles, recently invented. Fitted to the soles of special sandals, the paddles spread out with downward or backward thrust of the leg and close with a forward or upward movement. They will be found especially helpful, it is believed, to water polo players and others who must make quick movements in the water or who find it necessary to tread water for long periods.



PLAN BROADCAST WITH MIKE IN DIVER'S MASK

BROADCASTING from the floor of the ocean will be attempted soon from New York harbor in conjunction with a scheduled test of a new life-saving mask. An inch-square microphone is sealed in the mask, as shown above, will be the source of the broadcast. Waterproof microphone cord will carry the voice of the diver to a small transmitter in a boat on the surface. The mask is expected to enable a diver to descend seventy feet without air line from the surface. Oxygen will be supplied him by small tanks strapped to his back.

PAPER BAG KEEPS DRIED MILK FROM SPOILING

CAPABLE of keeping dried skim milk in perfect condition for three weeks, a moisture-proof bag was recently tested by the Dairy Bureau of the U. S. Department of Agriculture. An outer bag of bond paper and an inner bag of two layers of glassine and paraffin protect the milk.



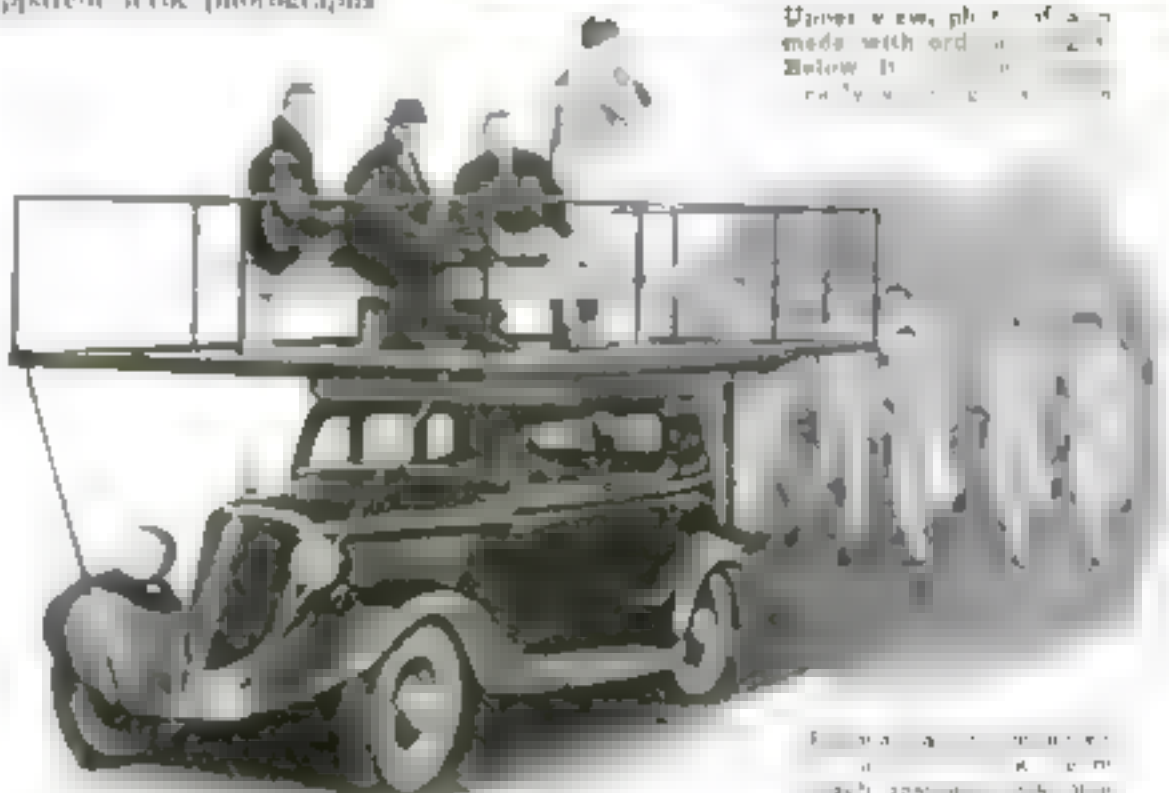
New paper bag that keeps dried milk in condition for weeks.

INFRA-RED PHOTOS SHOW VEIN DISEASE

VARIOUS veins and other conditions that interfere with the circulation can be detected with comparative ease by a method of photographic diagnosis recently demonstrated at Rochester, New York. Human skin it was discovered is nearly transparent to infra-red rays. By using film that was sensitive to this invisible light, photographs were taken in which veins lying just below the surface of the skin stood out clearly. Any derangement was readily apparent in the photographs.



Various views, photographs made with infra-red light. Below is a photograph of a person's arm.



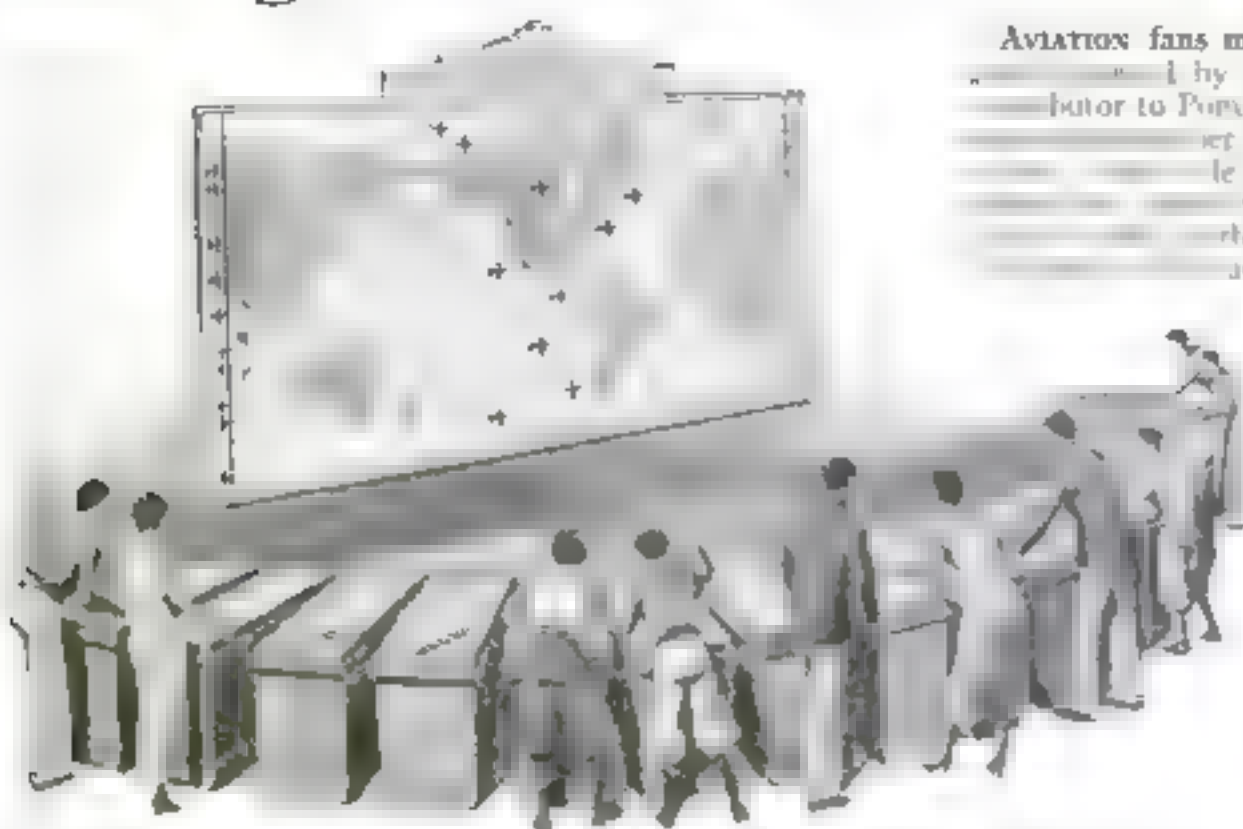
Coach teaches runners from platform on car.

COACH TEACHES RUNNERS FROM PLATFORM ON CAR

TAKING his cue from rowing coaches who use motor boats to follow their crews, Coach Nicholson of the Notre Dame track team utilizes a motorized

platform to keep an eye on his runners as they go through their paces. From the platform, which is built on top of a sedan, Nicholson notes defects in running style.

Racing Electric Planes Is New Aviation Game



Racing electrically propelled airplanes in flight around the world is a new game for aviation fans

Aviation fans may play at a round-the-world race in a new game invented by Assen Jordanoff, veteran pilot and frequent contributor to *POPULAR SCIENCE MONTHLY*. Each of the players—up to twenty—chooses a toy plane that moves over a map of the world. Its movement is controlled by a familiar amusement device in which marbles that fall, according to his luck and skill, have a scoring value. When a marble drops through a hole it establishes an electric contact and starts a motor that runs the plane, which continues to move all the time the marble is returning to the base of the game board. The holes farthest from the player produce the longest hops, since the marble closes the contact for a longer time. The player whose plane first reaches the far end of the course is the winner.

WONDERLAND AT FAIR

POPULAR SCIENCE MONTHLY invites you to visit its Mechanical Wonderland at the World's Fair in Chicago. It is the exhibit that was the talk of the 1933 exposition and it is again on view in the General Exhibits Building near the Hall of Science.



USE GAS GUNS TO TAKE WILD ANIMALS ALIVE

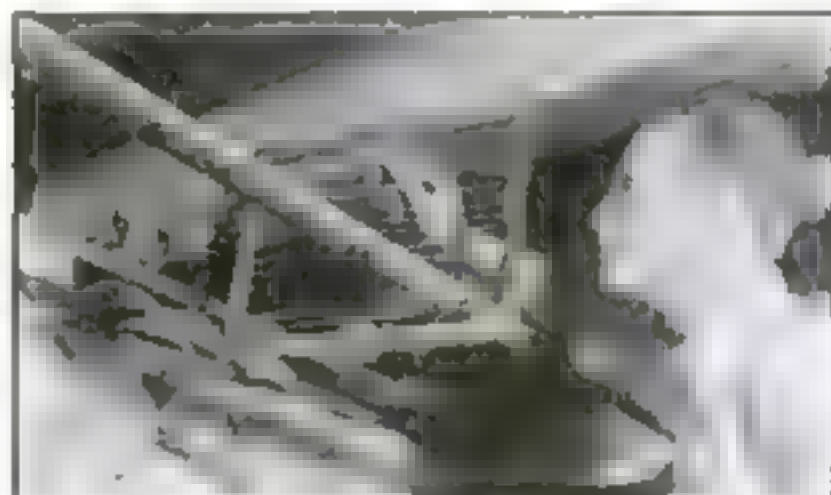
GUNS that shoot gas instead of bullets will be used by an American expedition now on the way to Central and South American jungles in an attempt to capture wild beasts alive. In this way they hope to obtain specimens for exhibition and breeding purposes. The gas stream temporarily disables an animal without permanent ill effects, and is said to be effective at an extreme range of 150 yards. Above, the outfit led by Dr. Wolfgang Von Hagen, leader of the expedition.

AIR-PRESSURE PUMP HELPS BUILD BRIDGE

A PUMP that looks like a dentist's gigantic drill is helping to construct the bridge from San Francisco across the Bay to Oakland, Calif. When submerged, the device delivers a jet of water under 300 pounds' pressure. The stream breaks up the material, so it can be removed.

HOMEMADE TRAP ELECTROCUTES RATS

Rats are exterminated electrically by a device set up in the basement of a Manhattan, Kansas, restaurant. A grill made by stretching wires across a picture frame encloses the water pipe the rats used as a runway. One side of a 2,500-volt secondary circuit of a discarded neon tube transformer is attached to the grill and to the pipe. When the rats touch the wires, they are killed.



Wire grill, connected to current supply, traps and electrocutes rats



Air-driven pump used to loosen bottom of San Francisco Bay for bridge work

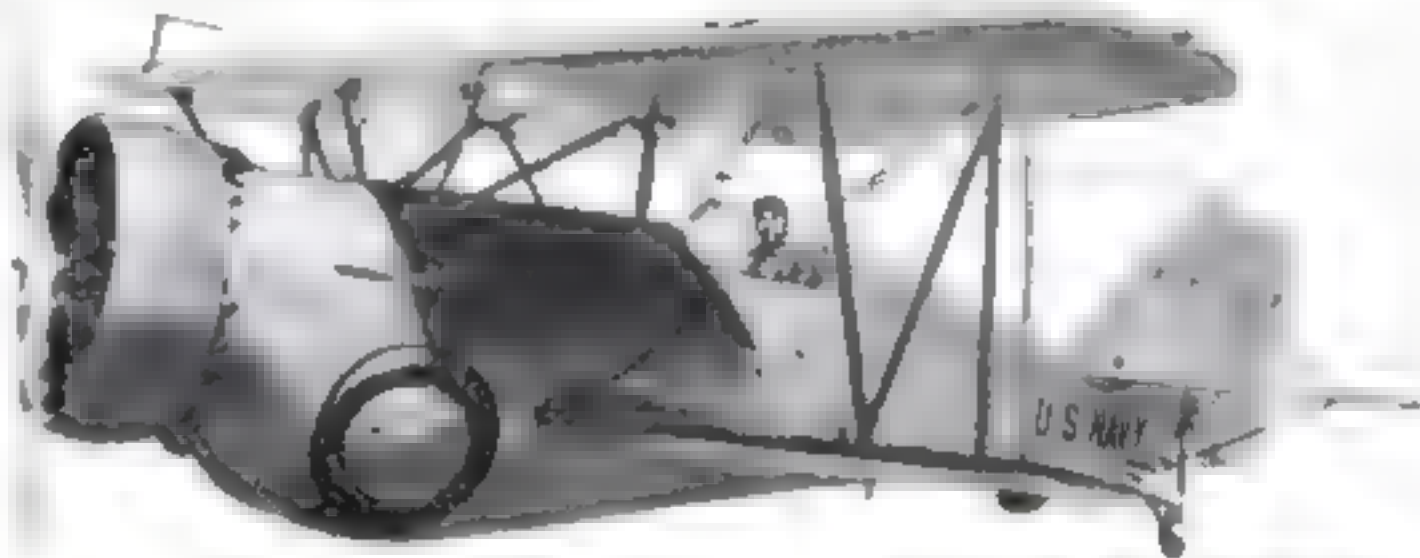
CHAINS HOLD GIBRALTAR IN PLACE

LONG renowned as a symbol of strength, the Rock of Gibraltar now has to be held together with chains. At the summit of the promontory guarding the entrance to the Mediterranean Sea, huge boulders are being anchored to keep them from falling. The photograph shows a member of the British garrison inspecting the chained rocks.



Fast Navy Plane Has Retractable Wheels

RETRACTABLE landing gear gives a sleek, streamlined profile to the Navy's latest high speed fighting plane, a single-seater Curtiss biplane. In flight the landing wheels fit into recesses in the sides of the fuselage. The ship is powered by a 700-horsepower radial engine, which is cowled to reduce wind resistance. The striking picture reproduced at right, an official Navy photograph, shows the new speed plane streaking like a projectile through the air.



STEAMBOAT MODEL RUN BY ELECTRICITY



Model of a stern-wheel Mississippi steamboat built by two St. Louis boys and powered and lighted with electricity.

Power from dry cells in the hold propels a realistic model of a Mississippi stern-wheel steamboat completed by two St. Louis, Mo. boys. A small electric motor is geared by clock work to the paddle wheel. The motor is lighted with small electric bulbs, as are the red port and green starboard lanterns on the smoke-stacks. A magnet radio receiving set within the craft supplies music in simulation of an excursion-boat band while the boat pursues a circular course about a park lake. The dry cells will operate the model for an hour.

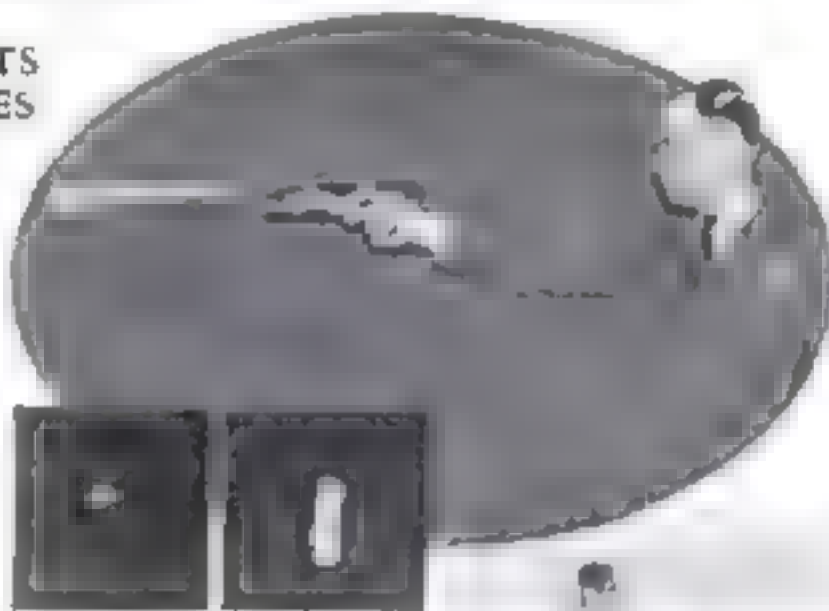


CUTS DOWN TREE WITH AX 9,000 YEARS OLD

Using a Scandinavian flint ax, 9,000 years old, Dr. Nels C. Nelson, curator of prehistoric archaeology at the American Museum of Natural History, recently felled a four-inch maple tree in six minutes to demonstrate that Stone Age man was not needless even though he had no steel. Dr. Nelson made the handle for the ax. The illustration above shows him with the ancient tool and part of the tree he cut down.

LIGHT BEAM TESTS SHOOTER'S NERVES

BALANCED like a regulation police pistol, a new flash-light gun shoots a light beam at a wall to test a marksman's steadiness of aim. Any wavering is disclosed by the telltale dancing of the beam when an imitation trigger is pulled. The device is the invention of Dr. Theron W. Kimer, New York physician whose researches in criminology have won him wide recognition.



In use, marksman tests nerve with flash-light pistol. Above, samples of steady and unsteady nerves.

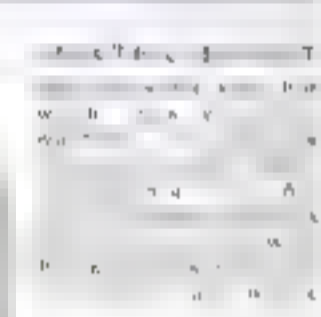
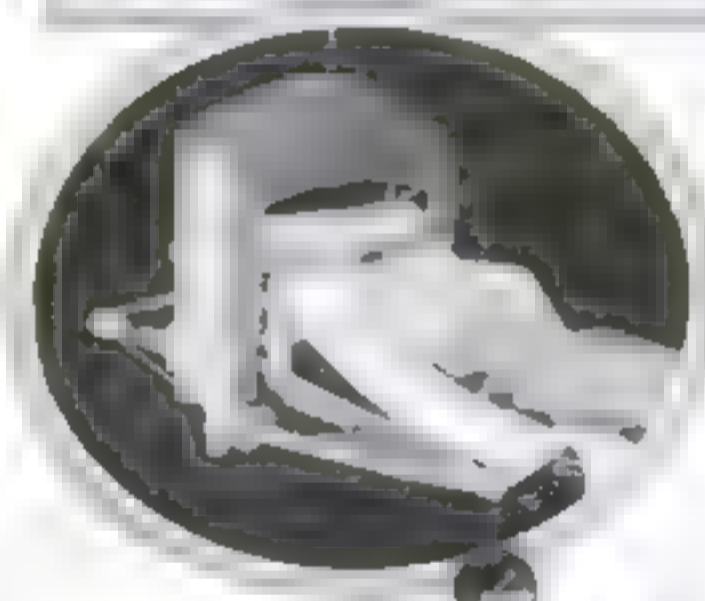
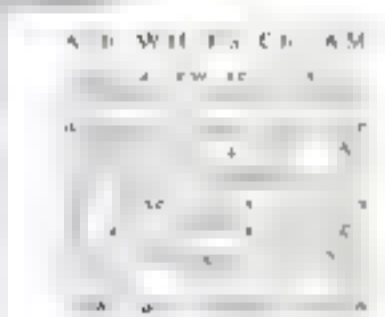
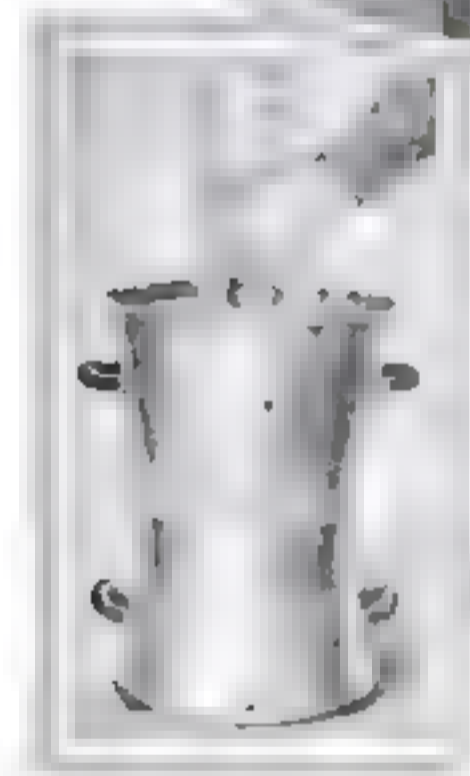
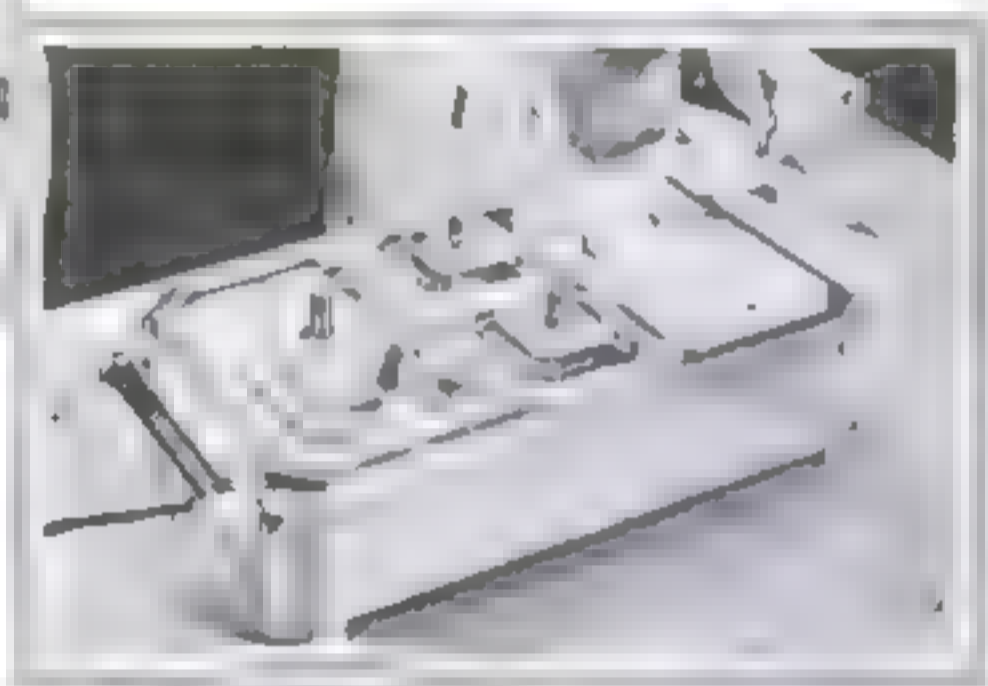
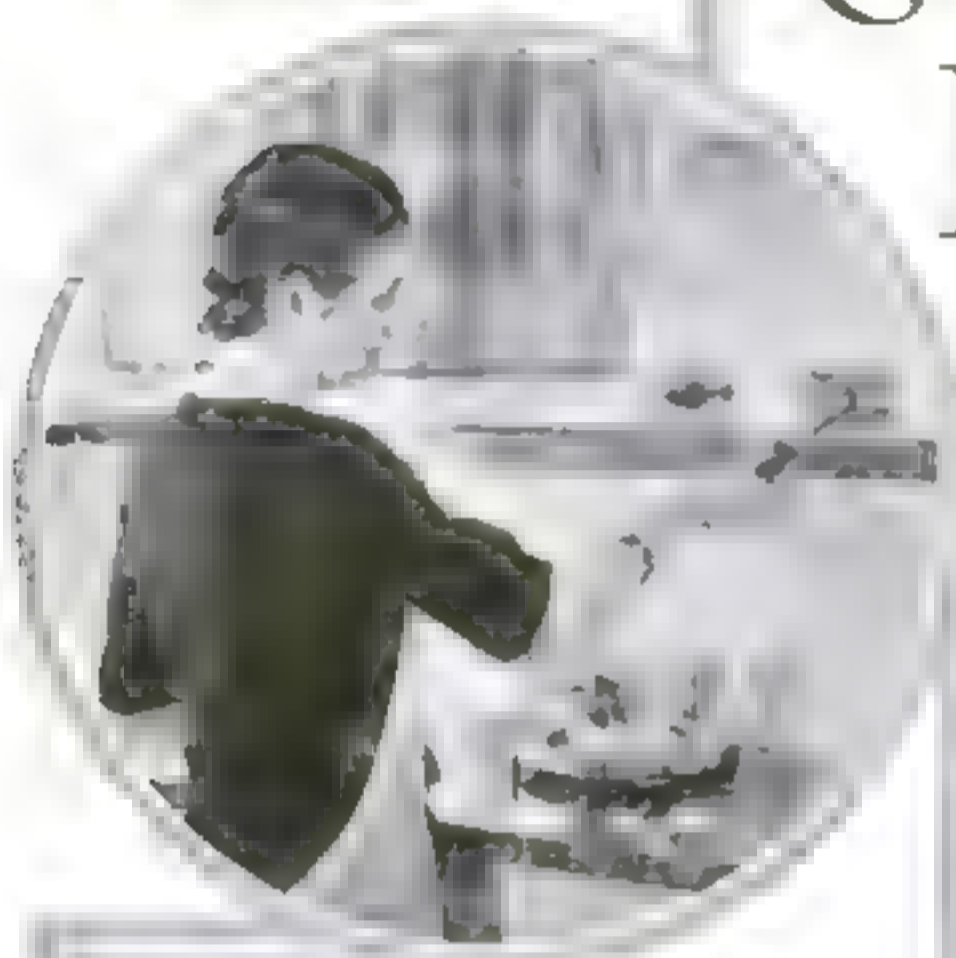
CABLE SAVES LIFE GUARD

SAFETY of the life guards at bathing beaches is assured by a new device recently tested at Tynemouth, England. A cable from a portable reel is attached to a padded jacket-like life preserver worn by the guard, as demonstrated at right. Should he become exhausted, the jacket will keep him afloat until he is drawn to shore by the cable. The apparatus also aids the guard in bringing in a rescued swimmer.



DISAPPEARING CORD. The new electric clothes hangers are made with a disappearing cord. When not in use, the cord disappears and the hangers hang as if by magic.

Latest Conveniences FOR THE HOUSEHOLD



CLOTHES HANGERS. The new electric clothes hangers are made with a disappearing cord. When not in use, the cord disappears and the hangers hang as if by magic.



HANDY ASSISTANT TO THE COOK This metal panel, which sticks to the kitchen wall, contains a memorandum pad, a three-months calendar, egg-timing glass, and clock dial, to time cooking

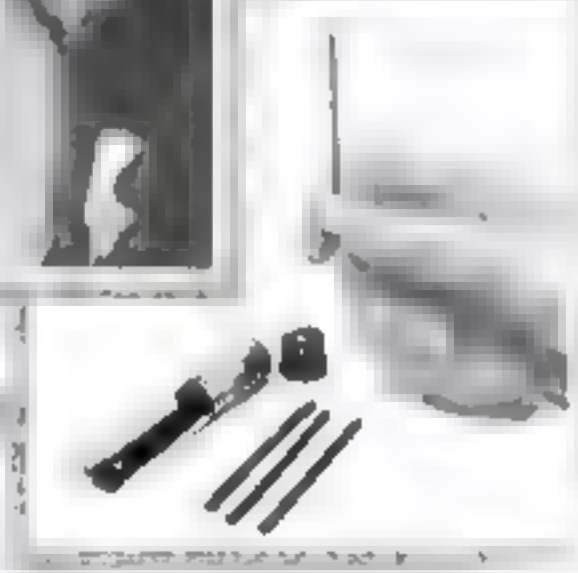
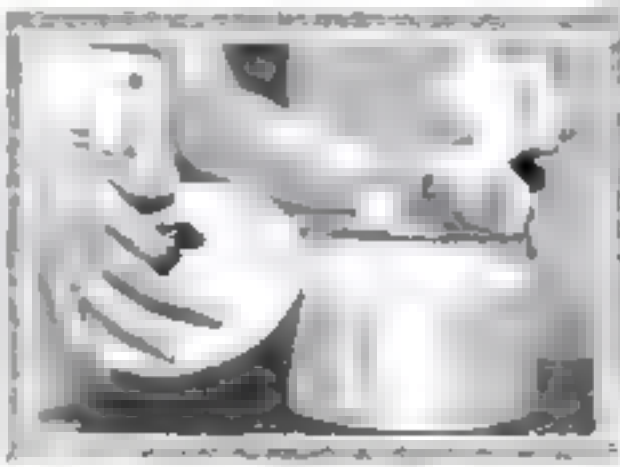


TOLCH OPENS
This metal panel, which sticks to the kitchen wall, contains a memorandum pad, a three-months calendar, egg-timing glass, and clock dial, to time cooking

ADJUSTABLE STEPLADDER The rear legs on this stepladder are adjustable to any desired length, with the result that the ladder can be used on stairs or on slanting ground



WIRE BOTTLE HOLDER. Clipped over the neck and bottom of a bottle, this wire holder makes it easy to pour out the contents



INCENSE CANDLES Pleasantly perfumed, these tiny candles will burn for twenty minutes and fill the room with agreeable odor. The glass tube container in which they are sold, keeps them fresh



NEW PAPER FOR THE KITCHEN Paper in new form is now available for a variety of household purposes. Your vegetables may be wrapped in odorless parchment, as at left, and cooked without blend of flavor. Another kind of paper can be used to give a table top a lustrous finish, as seen above

Dangerous ACIDS

MADE SAFELY BY
Home Chemist



At left, nitric acid fumes rise from the retort which contains a nitrate and sulphuric acid. The fumes condense to nitric acid when cooled as shown. Below apparatus used in this experiment in making an acid.

flask at the left. Being soluble, it combines with the water and a weak solution of sulphuric acid results.

Unaided, the original sulphur dioxide formed by the burning sulphur would not follow the desired course through the various tubes and bottles. To pull it through the system, suction must be applied to the mouth of the absorbing flask. This can be done by allowing water to siphon from a gallon jug and applying the suction formed in the jug to the absorbing flask by means of a length of rubber tubing as shown in the drawing.

To prepare the iron oxide catalyst for this experiment, soak some asbestos fiber or pumice stone in iron chloride or some other iron chemical solution until the mass is well saturated. Then add ammonium hydroxide (ordinary household ammonia will serve). This will precipitate iron hydroxide in the pores of the asbestos or pumice. The liquid then can be poured off, fresh water added and shaken and also poured off.

Next heat the impregnated pumice or

By
**RAYMOND B.
WAILES**

BECAUSE they enter into a wide variety of reactions, acids form an interesting and important group of chemicals. By preparing them in small quantities, the home experimenter can learn a great deal about chemistry and its many mysterious reactions and valuable processes.

The fact that many acids are considered dangerous should in no way dampen the amateur chemist's ardor. Handled cautiously, they are as safe and harmless as a sharp knife in the hands of one who is careful and dexterous. They should, of course, be stored in glass bottles and kept away from clothing and hands. If some acid is spilled accidentally, it should be neutralized immediately by applying a base such as ordinary baking soda.

When diluting a strong acid, always pour the acid into the water, adding it slowly and stirring the mixture with a glass tube or rod. Never pour the acid in quickly. If you do, enough heat may be generated when the two liquids mix to form steam bubbles that will blow the acid and water out of the container.

Although the amateur chemist with his meager supply of equipment cannot prepare concentrated sulphuric acid in his home laboratory, he can manufacture it in a weak form that will illustrate the method and serve to introduce an important chemical phenomenon called catalysis.

To prepare sulphuric acid, you will need some sulphur, water, calcium chlor-

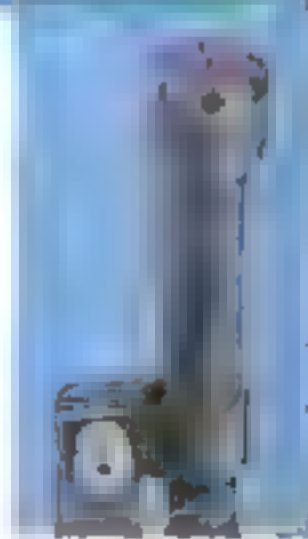
ide, and iron (ferric) oxide. The experiment is a simple one and requires only homemade apparatus consisting of a bottle, a flask, glass tubing, a few corks, a glass funnel, a gas burner and rubber tubing. The parts should be arranged as shown in the illustrations. Flowers of sulphur placed in the shallow lid from a tin can is burned under the funnel at the extreme right. The sulphur dioxide formed together with some air is collected by the funnel and then passes through a drying bottle, containing the calcium chloride, to the horizontal tube of hot iron oxide. The presence of the hot iron oxide causes the sulphur dioxide to steal oxygen from the air and become sulphur trioxide. Because in this reaction, it induces a chemical change in another substance and is unchanged itself, the iron oxide is said to be a catalyst.

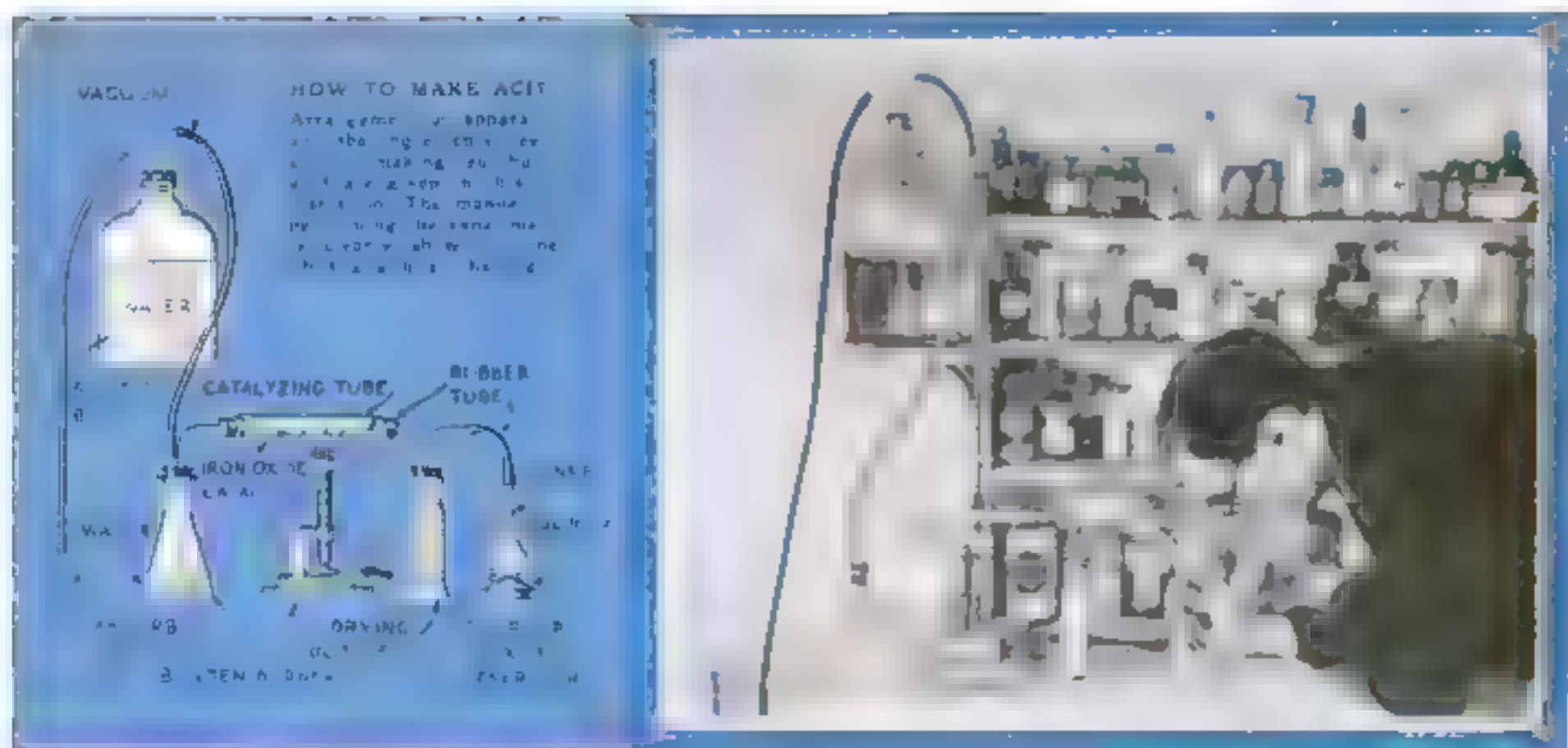
Finally the sulphur trioxide formed is bubbled through water in the absorbing



With the apparatus shown above, sal ammoniac can be broken down into ammonia gas and hydrochloric acid gas. The presence of gas is determined with litmus paper.

This flame spreader, useful in experiments with acids, is made with holes and glass in burner cap as told in text.





asbestos in a crucible or tin-can lid over a gas burner. This final operation will convert the iron hydroxide into the desired iron oxide. The finished catalyst then is placed in the horizontal tube and heated gently with a gas burner as the sulphur dioxide is pulled through.

After burning about a teaspoonful of the sulphur, remove the absorber from the system and test the liquid with a piece of blue litmus paper. If an acid is present the paper will turn pink. To prove that it is sulphuric acid, place a small quantity of the liquid in a test tube and add two drops of hydrochloric acid followed by several drops of barium chloride solution. If sulphuric acid is present a white precipitate will be formed.

Although sulphuric acid made by this simple process will be weak, it should dissolve bits of magnesium and attack pieces of zinc to produce tiny bubbles of hydrogen gas. Of course, the concentration of the liquid can be increased by boiling but even then the home chemist will find that the acid will be too weak to be of any great value for experimental purposes.

It is interesting to note however that this same type of contact process is used commercially to manufacture sulphuric acid. Of course a more expensive substance, usually a form of platinum is used as the catalyst.

While the home chemist will be interested particularly in the chemical uses of sulphuric acid, he can perform a novel experiment to illustrate one of its important physical properties. In a concentrated form sulphuric acid is capable of absorbing large quantities of moisture from the air. For this reason it is often referred to as being hygroscopic. To understand this action more clearly place some strong sulphur-

ic acid in a small vessel and expose it to the air. The acid will absorb so much water from the surrounding air that it soon will overflow the container.

Besides many of its other valuable uses, concentrated sulphuric acid can be used to produce another useful chemical—nitric acid. This is done by placing some sodium nitrate or potassium nitrate in a glass retort and adding a quantity of sulphuric acid made by mixing equal parts of the acid and water. When the chemicals are heated, nitric acid vapors will be given off and can be condensed to a liquid by cooling.

To condense these vapors, the best procedure is shown in the photograph. Insert the end of the retort outlet tube in the mouth of a flask and rest the flask in a glass funnel. A stream of water directed on the upper face of the flask then will serve to cool it and condense the vapors leaving the retort. The funnel will serve to catch the cooling water which can be led through a rubber tube to a drain or a

large pan or bottle placed on the floor.

Nitric acid manufactured by this method will be found to be quite energetic in its action with metals, carbonates, and other chemicals. Because of its activity it should be stored in glass-stoppered bottles. It will attack both cork and rubber.

By using sulphuric acid and a small amount of iron sulphate solution, the home experimenter can test for the presence of nitric acid or nitrates. Simply place about a quarter of an inch of the sulphuric acid in a test tube, add an equal amount of iron sulphate solution, being careful not to shake the tube, and then slowly add the liquid to be tested by allowing it to run down the walls of the tube. If a brown ring is formed when the solution reaches the area between the acid and the iron sulphate and gentle heating causes the ring to disappear, it is proof that either nitric acid or a nitrate is present.

Hydrochloric acid, a third member of the important acid family, can be pro-

duced by adding ordinary table salt to sulphuric acid and heating the mixture. Like nitric acid, hydrochloric acid also should be made in an all-glass retort. The end of the exit tube dipped into a water-cooled flask of water then will lead the gas through the water where it will be dissolved to form liquid hydrochloric acid. Although the home chemist can manufacture hydrochloric acid by this method, it will be less expensive and troublesome to use commercial muriatic acid (highly impure hydrochloric acid).

It is a simple matter to test the distillate formed for hydrochloric acid. If a drop of silver nitrate solution is added to any solution of a chloride, a white curdy precipitate will form. (Continued on page 106)

STRANGE FACTS *about* ACIDS

Formic acid was made at one time by distilling red ants.

Acids are responsible for the taste of many fruits.

All acids contain hydrogen.

Acids turn blue litmus paper red.

Soda water and soft drinks contain an acid.

Many acids are merely solutions of gases in water.

Sulphuric acid eats wool clothing and wood by decomposing it and stealing the hydrogen and oxygen.

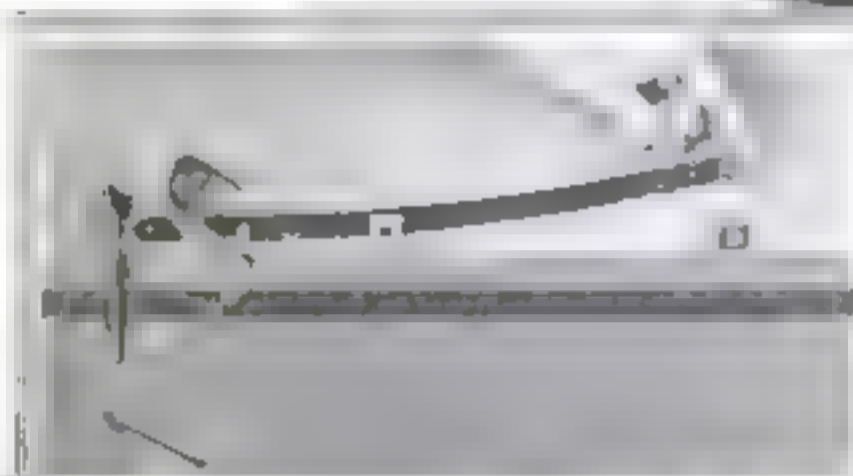
Because of its oily appearance, sulphuric acid often is called oil of vitriol.

A fire can be kindled by dropping concentrated nitric acid on wood shavings or straw.

Scientific Facts Easily Demonstrated in Your Own Home



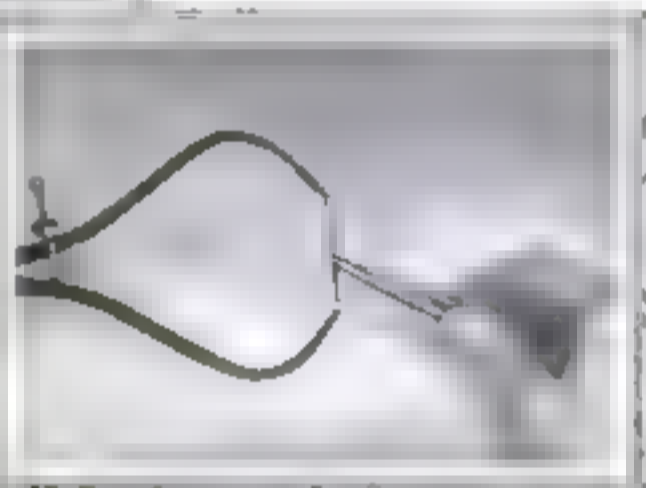
FUN WITH GRAVITY Two objects dropped from the same elevation will strike the floor at the same time regardless of distance in time, weight, and horizontal speed. To prove this, two balls are snapped off a table by a saw blade clamped as shown at right. One goes a short distance and the other flies across the room yet they land simultaneously.



AN UNDERWATER MIRROR. The surface of water in a vessel forms a reflecting mirror as can be seen by floating a cork with a ball stuck in its lower side. When viewed from below, the reflection of the ball is seen projecting above.



FLUTTERING BUTTERFLIES To the wire loops of a bell-ringing transformer attach two paper butterflies. When a permanent magnet is held over the wires as shown, the butterflies will flutter in a life-like manner. This is due to the interaction of the two magnetic fields that are set up by magnet and the alternating current.



HEATED METAL EXPANDS Measure a nail with calipers as illustrated above. Then heat the nail red hot and holding it in pliers, insert it as quickly as possible between the jaws of the calipers. The fact that it is longer than when cold instantly becomes apparent.

SQUEEZING A BOTTLE

To show that you can compress a bottle by squeezing fill it completely full of water. Pierce a cork with a needle and fit it in the bottle. Then squeeze the bottle as shown. Water will be forced out through the hole in the cork.



HELD DOWN BY WATER A test tube is loaded with shot and fitted with a wire ring as is illustrated above. It will float in the position seen, but if the ring is forced into contact with the water it will remain there, being held down by surface tension.

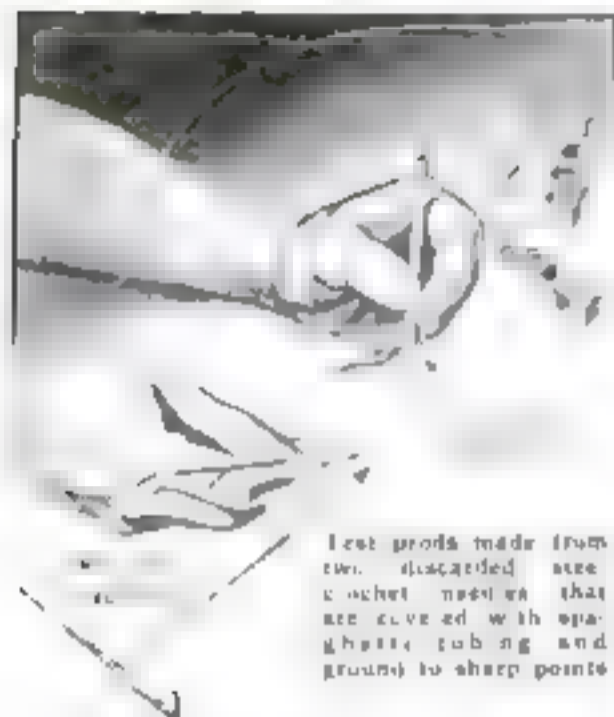


VIBRATION WAVES Attach a piece of thread to a buzzer that is vibrated by a bell-ringing transformer as at right. You will then see that two trains of waves travel in opposite directions along the thread. The still points are called nodes and the curved parts of the waves are loops.



A SAFETY LAMP Put a funnel in a gas jet as shown and on top of the funnel place a wire screen. When the gas is turned on, you can light it above the screen but it will not burn in the funnel as the screen keeps the gas beneath it too cool to burn. This is the principle used in safety lamps carried by miners.

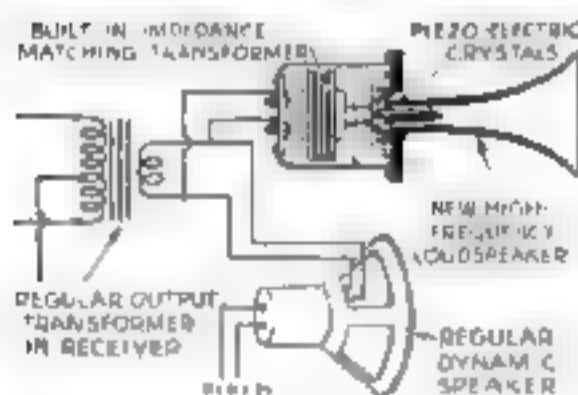
Timely Hints for Radio Fans



Test prods made from two discarded steel crochet needles that are clad with spaghetti tubing and ground to sharp points

Homemade Test Prods

NEEDING a pair of test prods recently in my radio experimenting, I decided to see what my junk box could offer before investing in a ready-made pair. In my search, I ran across two steel crochet needles and a length of heavy spaghetti tubing. I tied the ends of the needles to a sharp point, forced the tubing over them to form insulated handles, and soldered a length of connecting wire to the upper end of each. Then I connected a small spring clip to the other end of each lead wire and my test prods were complete. Because their steel ends will hold a point, I find them better than the average run of commercial prods when it comes to puncturing insulation.—H. L. B.



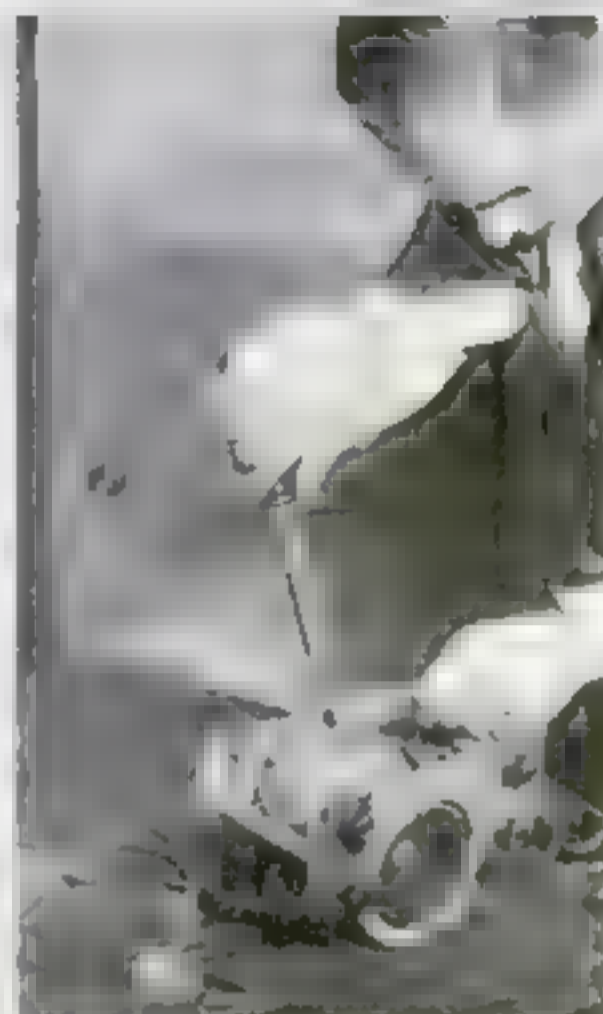
High-Frequency Speaker Is Easily Installed

RESEMBLING an automobile horn, a new type of high-frequency loudspeaker has been devised as a supplementary unit for modern broadcast receivers. Although the ordinary dynamic speaker will reproduce low tones faithfully, it fails to respond to the higher notes so necessary to the naturalness of voice and music. When this new speaker, operating on the

piezo-electric properties of Rochelle salt crystals (P.S.M., Oct. '33, p. 57), is connected to the voice coil of an existing loudspeaker, however, it faithfully supplies these missing tones up to the physical limits of the human ear. To guarantee distortionless operation and eliminate the necessity for a costly filter network, the unit is fitted with a built-in impedance-matching transformer.

Adding Earphones to Short-Wave Set

MANY readers who have constructed the five-tube loudspeaker short-wave receiver recently described (P.S.M., Apr. '34, p. 62) have asked if it is possible to use headphones with this set. It is—and they will be particularly valuable in picking up distance, especially on the shorter waves. One of the best ways to connect in the headset, and at the same time furnish some means of silencing the built-in speaker, is shown in the diagram above. The supplementary earphone circuit consists simply of an additional 3,500 or 4,000-ohm output transformer and a small single-pole, double-throw switch. Thrown in one direction, the switch connects the receiver to the dynamic speaker transformer in the usual way. Thrown in the other direction it cuts the speaker out of the circuit and replaces it with the new transformer and headphones. The switch can be of the toggle variety mounted either on the front panel or at the rear of the chassis beside the power switch.—L. W.



Collecting Listener's Cards Is New Hobby

WITH the popularity of the short waves, the hobby of collecting QSL cards is no longer limited to the operators of licensed amateur short-wave stations. Owners of all-wave sets also are now eager to check up on the signals they hear

and are sending listener's cards to every station or station they log. On these cards they state the time and date the signals were received, the quality of the reception, and the type of receiver used. In return for this information, they request a verification card from the station owner. These cards they then display on the wall or mount in a much-cherished album.

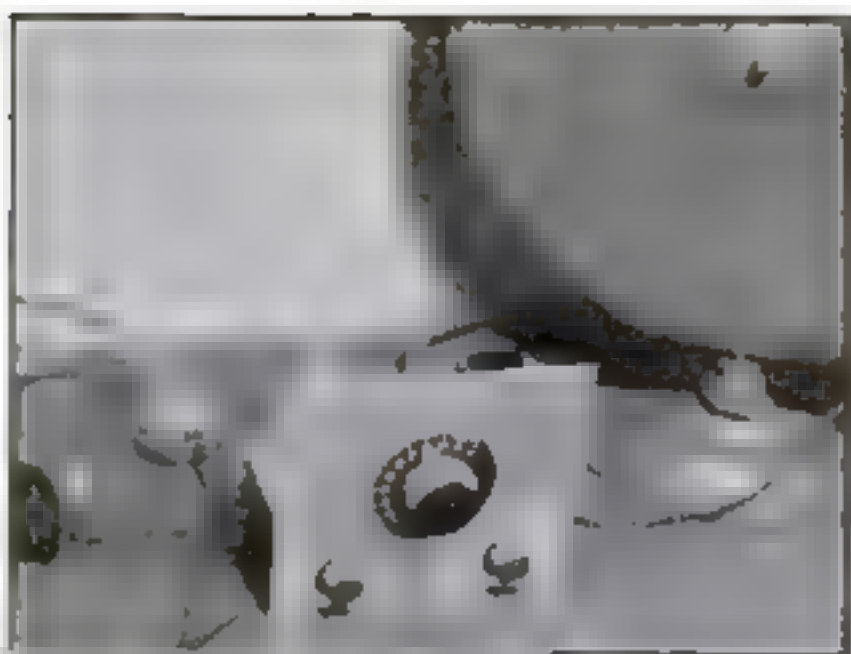


With this long-wave coil your short-wave receiver can be used on long-wave bands

Long-Wave Coil for Short-Wave Sets

BY USING a special long-wave coil recently developed, the owner of a short-wave receiver now can explore the longer wave lengths above the broadcast band. Plugged into any "plug-in coil" set, it converts the circuit automatically into a first-class long-wave receiver that will cover all wave lengths from 450 to 2,140 meters. As shown by the photograph at the left, the coil is bank wound with Litz wire on a standard four-prong coil base. At its top are two terminals. These receive small fixed condensers that serve to alter the coil's range in small steps.

THIS
Two-Tube Set
HAS ONLY
One Tube



GEORGE
H.
WALTZ,
JR.

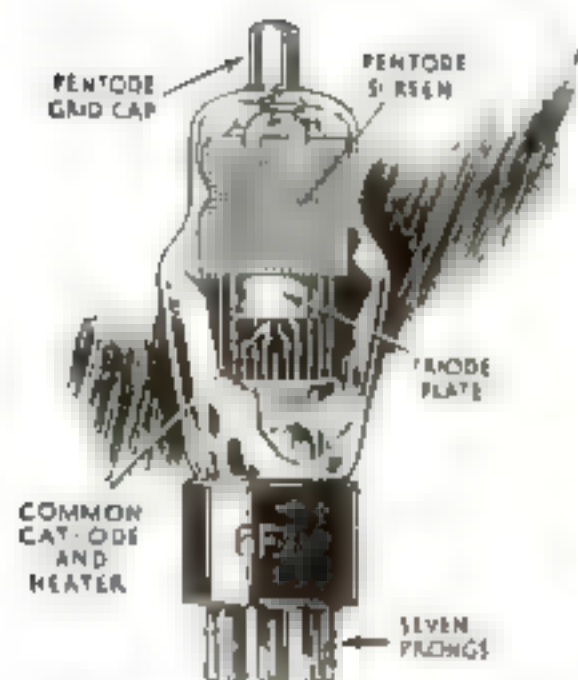
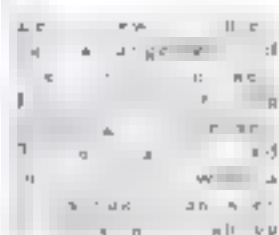
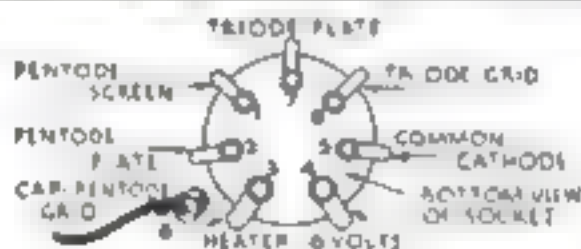


Illustration shows the duplex nature of the GP7 tube, which is really two tubes in one.

ALTHOUGH only one tube is used in the short- and broadcast-wave receiver shown, it is in reality a two-tube outfit. Built around a new style duplex tube the 6F7, the circuit consists of a combined regenerative detector and resistance-coupled amplifier.

In spite of its simplicity and compactness, the set is particularly efficient. When tested recently in New York City with a fair-sized antenna, sufficient volume was obtained on the broadcast band to operate a magnetic speaker—quite a feat for what appears to be a one-tube set.

Those who have built the beginner's



Bottom view of seven prong socket necessary for 6F7 tube. Removable set of connections.

one-tube described last month will notice some similarity in the general circuit and panel arrangement. This was done for a purpose. By making a few changes in the one-tube receiver and substituting a new tube and socket, it can be converted easily into this one-tube two-tube.

To understand the operation of this compact circuit, it will be necessary first to know something about the tube it uses. If you were to break open the glass bulb of a 6F7, you would find that virtually it is two tubes in one. At the top, directly under the metal grid cap, you would find a construction resembling a five-element screen-grid tube. Below this you would see what appeared to be a simple three-element tube. In the circuit the screen-grid pentode portion forms the detector while the three-element section serves as the amplifier.

The tuning section of the receiver is the same as that used in the beginner's one-tube receiver already described. The main changes in the circuit are the lack of a filament rheostat, the addition of two fixed condensers (.0005 microfarad), two

resistances (50,000 and 100,000 ohms), a coupling condenser (1 microfarad), and a new position for a small grid leak (1 megohm). The hole in the front panel and chassis formerly occupied by the filament rheostat can be used in mounting a heater switch of either the toggle or knob variety.

The chassis layout consists of a four-prong socket for the plug-in coils (designed for use with a .00014 microfarad variable condenser), a seven-prong socket for the 6F7, and several holes for connecting wires and grid-cap lead. Although binding-post terminals were used in the one-tube for battery connections, a six-lead battery cable will be more convenient in this outfit.

Perhaps the most difficult wiring job in the circuit will (Continued on page 111)

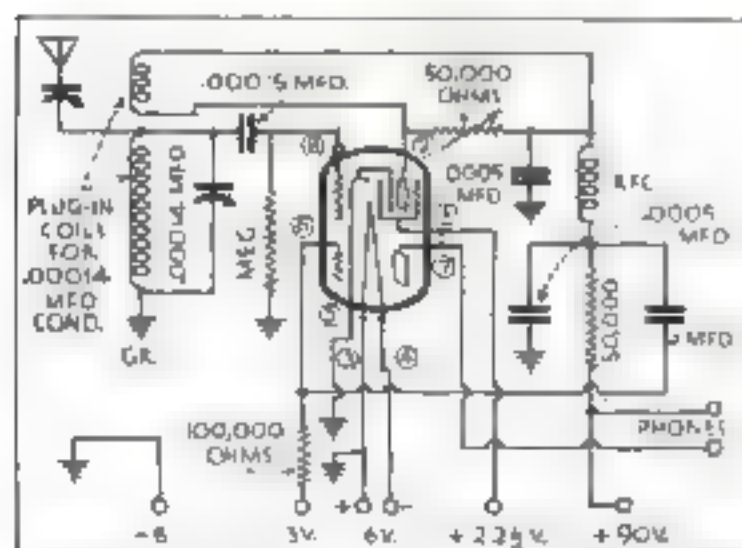
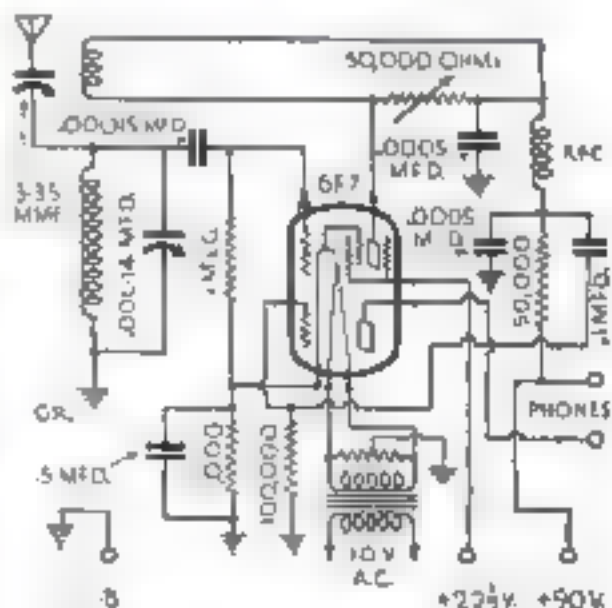


Diagram of the two-tube-in-one set showing the circuit as it is wired for the full battery operation



By making changes in the circuit the heater battery can be replaced with transformer

Compact Short-Wave Set

INGENIOUS OUTFIT EASILY
BUILT AT TRIFLING COST

By
*Frank
Lester*

DESIGNED as an ideal unit for the beginner as well as the advanced amateur this sensitive all-electric short-wave receiver represents the maximum in equipment for the minimum in cost. Including tubes and chassis, the complete assortment of parts can be purchased for \$13.45.

Using the newest type tubes, a '58 a 2A5 and an '80 rectifier this is the result of many months of experimenting to build a high-grade receiver that would be foolproof, easily efficient, and yet be within the reach of every radio fan. As the diagram indicates it is a carefully matched arrangement consisting of a radio-frequency amplifier, a regenerative detector, employing commercial three-winding (six-prong) plug-in coils, a resistance-coupled amplifier, and a simple alternating current power pack.

Three controls and a power switch operate the receiver. The main tuning condenser connected across the secondary winding of the three-winding coil, has a capacity of .00014 microfarad. Across it is a second and smaller condenser (.00002 microfarad). This is a sensitive trimmer unit. Regeneration control is obtained through a 30,000 ohm potentiometer.

For ordinary operation by the average short-wave fan, the large tuning condenser can be mounted in the center of the main

receiver panel, the trimmer below at the left and the regeneration control below at right as in the photographs. However an alternate method of placing the controls also is possible. For band-spread effect in definite bands, the positions of the main tuning condenser and small trimmer may be reversed. The trimmer condenser then is used as the tuning control and the larger unit as the tank or band-setting condenser.

To provide every possible combination and extend its utility to the limit the circuit has been designed to operate a dynamic speaker as well as a magnetic speaker or ordinary headphones. Two sets of terminal strips (sometimes referred to as phone jacks) placed at the rear of the chassis one above the other simplify the connections. The dynamic speaker voice-coil leads enter the circuit through an output transformer while the high-impedance terminals for earphones or a

magnetic speaker are connected to ground and through a small fixed condenser (.25 microfarad) to the plate of the 2A5 output tube. (Of course when a dynamic speaker is used it will be necessary to supply field current.)

In wiring the receiver, the first step should be to install the power cable and wire it into the circuit. Two wires in the cable lead to the on-off toggle switch mounted on the receiver panel between the trimmer and regeneration control. In placing the cable wires, bear in mind that all leads carrying alternating current must be twisted together. This applies to the on-off switch leads as well as the heater connection wires. As shown the heaters should be connected in parallel.

To operate the receiver an alternating current power pack is required. The circuit shown has been designed to supply approximately 250 volts direct current B supply at 60 milliamperes and 2½ volts alternating current for the heater supply at 4 amperes.



Shown above is the compact short-wave receiver. Below is the power supply unit. The receiver is a small, rectangular unit with a carrying handle on top. It has several knobs and a switch on its front panel. The power supply unit is a larger, rectangular unit with a carrying handle on top. It has several terminals and a switch on its front panel.

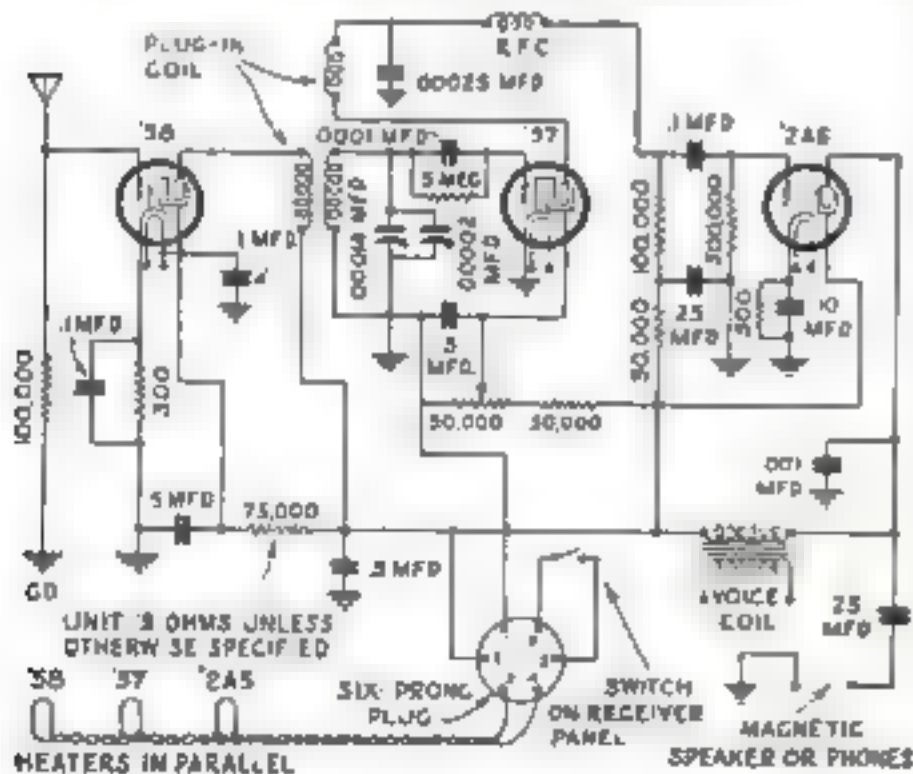


Diagram of the receiver circuit. The values for the parts are lettered on the drawing. A cable with six-prong plug leads to power supply.

How Is Your Driving Eye?



Miss an old skunk, the driver told him

By MARTIN BUNN

GUS WILSON nosed his car cautiously around a sharp bend in the pitch-black road. Suddenly the figure of a man appeared in the bright glare of the headlights. He was standing in the center of the road waving his arms excitedly.

"What's this," whispered Joe Clark as Gus jammed his foot on the brake, "a hold-up or an accident?"

As the car slid to a stop almost in front of the man, Gus poked his head through the open driver's window. "What's the trouble?" he called.

"I'm in the ditch a few feet up the road," came the reply from the darkness. "Will you give me a hand?"

When Gus had maneuvered his car safely to the edge of the road he aimed the beam of his flashlight down the steep embankment that bordered the concrete. There, wedged between two trees, was the ditched car.

"Gosh," exclaimed Gus, "How'd you manage to get down there? Somebody force you off the road on that turn?"

"Yeah, an old skunk," replied the man sheepishly.

"A skunk," repeated Gus. "I've heard of skunks driving people out of a house before but never off of a road. What did you do, try to miss him?"

"Not only tried, but succeeded," the man groaned. "And here I am. I swerved to one side, but I guess I misjudged the

distance and the next thing I knew two trees loomed up in front of me.

"Can't do much about getting her up out of there tonight," said Gus regretfully. "My name's Gus Wilson and this is Joe Clark. We own a garage in the next town. Suppose we give you a lift in and then come out here first thing in the morning with our wrecker."

"Fine idea," agreed the man. "My name's Townsend, I'm a salesman. Use my car for traveling. I'll put up at a hotel for the night, make some calls in the morning, and drop around in the afternoon and see about the car."

When Townsend arrived at the Model Garage the next afternoon, Gus was already at work trying to iron some of the wrinkles out of the mudguards and hood. "It's not as bad as it looked," Gus assured him. "No mechanical trouble and

by chopping away some of the bark on those trees we managed to coax her out without ripping the body apart. You're lucky you went between those trees instead of into them.

"I can't understand how it all happened," moaned Townsend. "I couldn't have turned more than a couple of feet to miss that barned pole cat and I've always been pretty good at judging distances on the road."

"Maybe your eyes aren't as good as you thought they were," suggested Gus as he wheeled the service jack under the car and started jacking it up.

Never wore a pair of glasses in my life," boasted Townsend. "And I've always made out better than the average in eye exams."

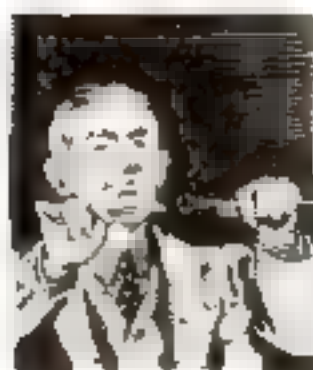
"Ever hear of blind spots?" inquired Gus between blows with a rubber fender hammer he was using.

Townsend shook his head.

Well, everybody has them. It's one spot in each eye where you're nearly blind. In most cases they're small and you don't notice them but sometimes they're large enough to cause trouble. We had a case here in town not so long ago. Tom Nevers, one of the best drivers I know, ran over a youngster. He argued that he never saw the girl and didn't know that he hit her until he felt the bump. Eyewitnesses claimed that the girl was standing there all the time waiting for a bus and that Nevers didn't seem to make any attempt to miss her.

The whole (Continued on page 110)

How to Test Your Eyes and Sense of Distance



Judgment of distances is tested by trying to bring two pencil ends together as seen above



If you have tunnel vision, you can't see your fingers when held at side of head as shown



You can spot the size of your blind spot with two dots on a card as is illustrated above



Speed with which you can transfer gaze from table to cup is a good test of your reactions



PEPPING UP YOUR Outboard Motor

HOW TO OVERHAUL IT SO AS TO INCREASE
THE SPEED FROM TEN TO TWENTY PERCENT

By

William Jackson

YOU can get much greater speed from an outboard motor, whether of the racing or service type if you keep it well tuned up. "Pepping" or "souping" are two of the colloquial terms applied to this process. Properly done, it yields a power increase of from ten to twenty percent.

The methods that follow are for the amateur racing enthusiast to whom 100 R.P.M. more or less may mean a race lost or won, but any outboard owner who likes mechanical work will also profit by having a faster motor for fishing or general service. After being tuned up, the motor will still pass inspection at sanctioned regattas, yet it will deliver a real wallop at the propeller end.

Dismantle the motor and place each part in a pan or box with its component nuts and bolts.

Balance and low frictional losses are two of the most important factors for speed. Therefore, to increase the volume of the gas and to reduce the retardation of the gas flow caused by the rough interior surface of the intake and intake ports, the entire passage from the carburetor to the cylinder combustion passages should

ASSEMBLING
THE PARTS



be ground smooth and polished to as flawless a finish as obtainable.

For smoothing and polishing the intake passages, an excellent way is to use an electric hand drill or motor with a flexible shaft equipped with small grinding stones of different sizes and a buffer. This equipment may usually be borrowed from a garage, or you can have the work done there inexpensively. Lacking this equipment, a good job may be done with files of various shapes and lengths and fine emery paper.

Start by grinding and polishing the carburetor outlet. Remove the butterfly valve from the carburetor solenoid each end of the shaft, and cut away the middle portion of the shaft to allow freer gas flow as shown in one of the sketches. The intake passages up to the cylinder combustion bypaths or ports are now ground or filed smooth and polished. Some motors have a small lip dividing the intake port. Do not cut this away but carefully grind and polish on each side.

Remove the valve of rotary valve motors, file, and polish smooth with fine emery cloth, or use the electric drill with a buffer and buffing compound.

After grinding and smoothing thorough-

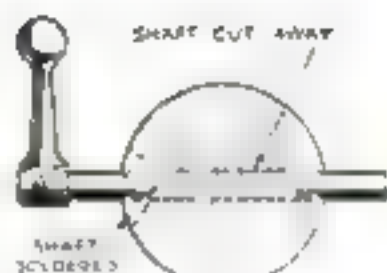
ly clean all the gas passages, including the important intake and cylinder ports.

Remove pistons from the connecting rods and examine for prominent bright spots caused by rubbing or metal-to-metal contact. Dress these spots down carefully with a fine file. The removal of .001 to .002 is generally sufficient.

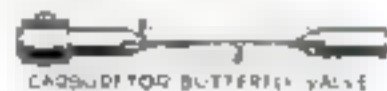
Whether the motor is old or new, remove the rings and free the grooves of carbon. Use care to avoid enlarging the grooves. A bent file sharpened as shown in one of the sketches is a good tool for this purpose. Whenever the motor is dismantled new soft rings of any good brand should be used to replace the old ones. Soft rings seat quickly and require very little running in. Assemble the rings on the piston and proceed to balance the assembly.

Use a jeweler's or druggist's scale to balance the piston assembly consisting of piston, rings, and wrist pin. For best results, balance pins and pistons separately. If one piston is found to be heavier the weight is adjusted by filing away sufficient metal from the piston head so as to balance perfectly.

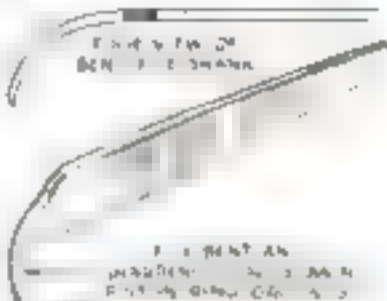
The piston assembly is now replaced on the connecting rod, and the cylinder refinished. As the cylinders in certain class 'A' motors using one cylinder block for both pistons are difficult to replace it will be found easier to fit one piston well up in the block before attempting to fit the other. Tighten the cylinder bolts.



SHAFT CUT AWAY



CARBURETOR BUTTERFLY VALVE



How butterfly valve of carburetor is modified and a tool for scraping grooves in piston



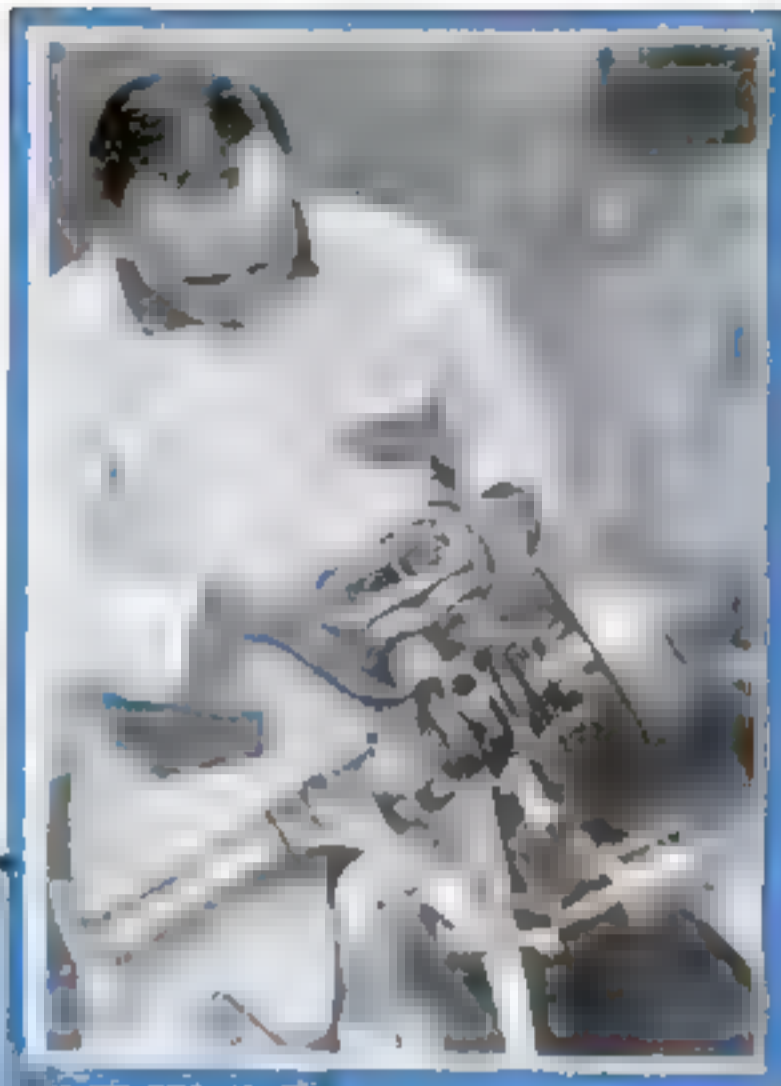
For developing maximum speed all the gas passages must be carefully ground and polished

Be sure that every trace of the polishing mixture is removed.

Now for the final assembly. New gaskets, of course, must be provided. Before replacing the cylinders, enlarge the various stud bolt holes very slightly by reaming. The reason for this will be shown. Squirt light oil on the piston assembly and bearings, and rebolt the cylinders. Do not tighten the cylinder nuts, however.

Obtain a small electric motor with just enough power to run the outboard motor or use a $\frac{1}{4}$ -H.P. motor with a milliammeter inserted in the line. With the pulley of the motor belted to the outboard flywheel start the electric motor. Now shut the cylinder block around on the crank shaft. It will be found that at certain points the electric motor will speed up or the milliammeter reading will drop, due to the decreased load. Securely fasten the cylinder nuts at this point as this is the point of lowest resistance or friction.

Reassemble the motor with the ex-



To replace piston assemblies in a cylinder block like this, set one piston well up in the block before fitting the other

ception of the lower unit. The gear cover of the lower unit is removed and the gears and interior given a thorough cleaning. Hot water will effectually loosen the old grease, which is then washed out with gasoline. Examine gears and shafts for any spots that may cause binding. Remove high spots by filing carefully.

For racing, replace the gear lubricant with light oil to which has been added a quantity of powdered graphite. Inspect after every race. For service work, auto oil like 600W is all right, or the regular outboard grease sold in tubes. Inspect and replace gear lubricant periodically. Provide new gaskets before replacing the lower unit. To reduce water resistance still more, file the edges of the skeg and cavitation plate to a sharp edge, and buff the lower unit or polish with steel wool. Remove dents and nicks from the propeller, and file the edges sharp.

For racing service do not use an unnecessarily large proportion of heavy lubricating oil in the gasoline as this causes piston drag with a consequent loss in R.P.M. Experiment will show the correct proportions of oil and gas. Special fuels are now available for a power increase of from 200 to 300 R.P.M., but they are rather expensive.

Better results may often be had on racing hydro by raising or lowering the motor or altering the angle of the motor on the transom of the boat. Choose the correct plugs for racing use.

Sharpen the leading edges of the fin and for a frictionless boat bottom smooth the finish with fine sandpaper and polish it with furniture or auto wax.



The reassembled outboard is belted to an electric motor and run in with a mixture of oil and some very fine abrasive

Clamp the outboard in a convenient position and belt an electric motor to it as shown. Obtain one pint of light oil and add to this a handful of a scratchless type of household cleaning powder or better yet, jeweler's rouge. Place the mixture in a squirt oil can. Run the motor for 25 or 30 minutes while constantly introducing this mixture through the spark-plug openings. This seals and polishes the pistons, rings, and cylinders. Next remove the cylinders and give the crank shaft, cylinder interior, pistons, and bearings a thorough bath with gasoline.

Picturesque Spanish Table

ORNAMENTED WITH IRONWORK

SPANISH type furniture, of which this table is an attractive example, is always direct and simple in construction, therefore easy for the amateur craftsman to build. This piece may be used as an end table, a small serving table, or a book table.

White oak is the most appropriate material for furniture of this type; the second choice would be Honduras mahogany, although mahogany is the better wood for carving. In construction, the project is so simple as to require little comment in addition to the information given in the drawings. It will be noted that a built-up pedestal or leg is suggested. The material is easier and cheaper to get in this form, and the piece is less likely to check and split. A little carving must be done on the feet, but is so easy that it will not prove difficult even to one with no experience in carving.

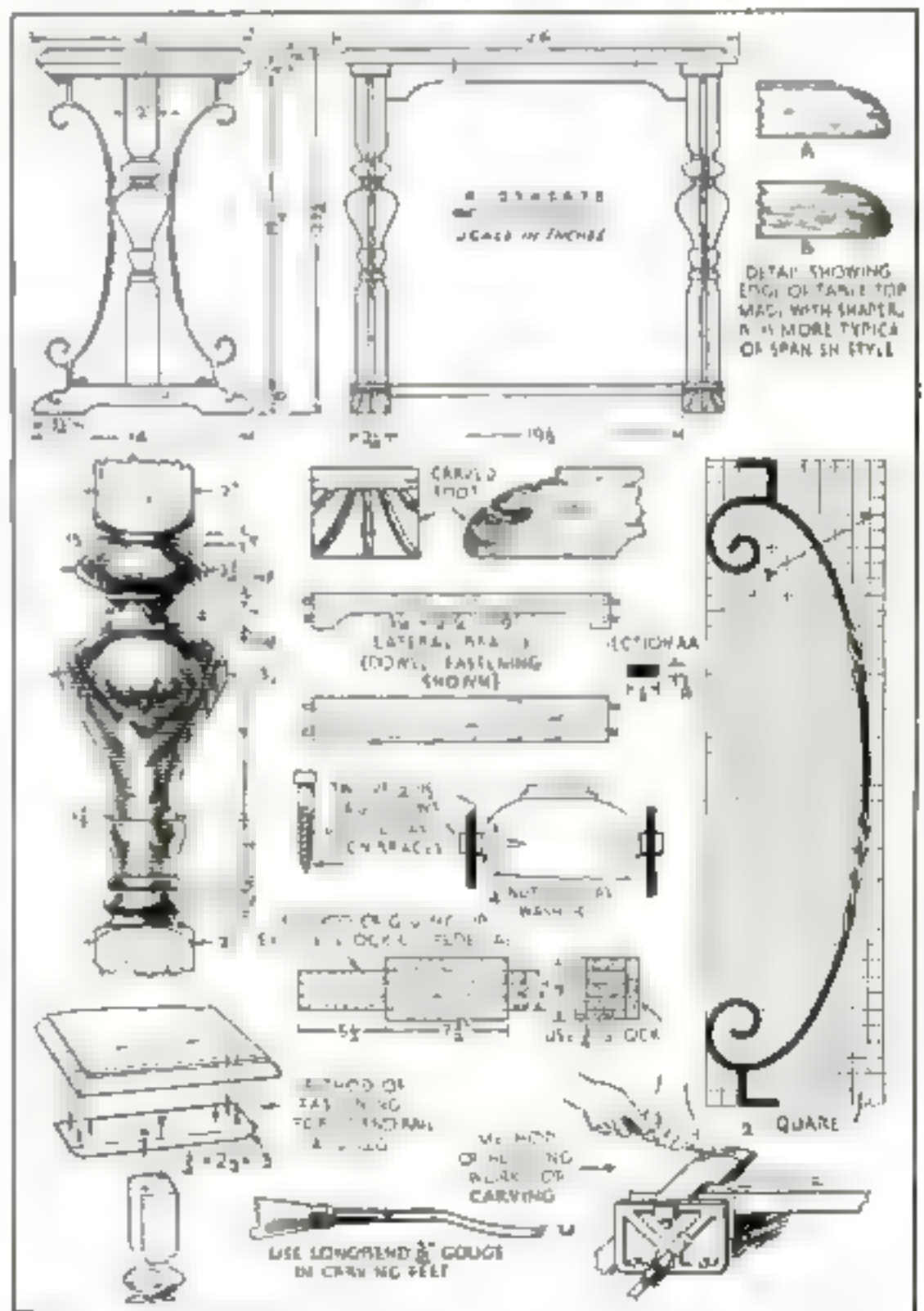
The ironwork is beyond the equipment of the usual home workshop and should be done by an ornamental ironworker. It will be easy to lay out the brace full size by drawing squares as shown and copying the design square by square. However, any competent ornamental ironworker can work directly from the design as given here. The iron is painted dull black. Slate blackboard paint makes a good finish.

When the table has been compacted and given the final sanding, it should be stained dark brown—some men called Spanish brown. If the work is done in mahogany, brown mahogany stain may be used. The wood should not be filled. After staining, it should be given a wash coat of shellac thinned with from five to seven parts alcohol. When the shellac is thoroughly hard, rub it down with No. 2/0 or 3/0 steel wool, and polish with wax.

An antique effect is often given in order to simulate the appearance of age. This may be done by dusting rottenstone on the wood and rubbing it in, or it may be mixed with the first coat of wax and thus rubbed into the open grain.



The design of this table dates from the finest period of Spanish furniture—from 1500 to 1610.



Recessed Panels Decorate Cigar Boxes



After the paper labels have been removed by steaming, recessed panels are carved to conceal the imprints.



The panels are outlined with cuts made at an angle of about 45 degrees with a sharp knife.

CIGAR boxes with close-fitting lids of the type shown can be ornamented with inset panels by the very same process used to remove the lettering imprinted in the wood. Such boxes are useful for playing cards, jewelry, letters, packs of cigarettes, and, of course, for cigars.

First, steam off the paper labels and stamps, being careful not to use more steam than necessary because the dampness may warp the box.

The spacing and location of the printing varies on different boxes. It is well to mark with a pencil or carpenter's gage just where all the inset panels are to be

and equalize the spacing even though the printing does not mar the entire area where the panel is to be placed.

With a sharp penknife, cut around each of the panels you have thus laid out. Make the cuts at an angle of about 45 deg. I have found that a beveled edge is easier to make and looks better than one cut straight down. The cuts should be about halfway through the thickness of the wood. The area within is then chiseled out. The recess can be given a smooth finish or it may be cut with a 1/2-in. gouge and the grooves allowed to remain.

After the carving is completed, the box should be sandpapered and stained, shel-

lacked, or painted. The inset panels may be stained or painted a bright color and the whole box then shellacked, or several colors may be used.—NORMAN K. MORSE

HOLDER FOR THERMOMETER

THIS holder for an outdoor thermometer was made from 1/16 by 1/2 in. brass strip. The size and position of the right-angled bends were determined by laying the thermometer on a sheet of paper and drawing the design of the proposed support directly around it.

The brass strip was annealed or softened before bending by heating it red hot and immersing in water. The bends were made with a pair of pliers and a short length of 1/4-in. square steel rod held tightly in the vise. Cup hooks, straightened out with pliers, were screwed into the top and bottom of the wooden thermometer base. The holder was then mounted with brass screws to the outside window frame. —R. W.



Bent brass strip holds thermometer outside window.

BOAT DOCK FOLDS BACK ON LAND

WATERCRAFT enthusiasts who have to build a new dock each year because the ice carries everything away can save themselves work by hinging the platform as shown. At the end of the season, the portion extending over the water may be lifted up and chained to a nearby tree, or

folded right back on the ground itself.

You can prevent your boat from being pounded by the waves if it is docked in the manner illustrated in the second photo. Drive a post or two parallel to the dock so that the boat will have at least a 12-in. clearance. Insert a small screw eye in the

center of each gunwale. Also place one in the extreme end of the dock and another 4 ft. to the rear. Nail a small pulley in the post opposite the end of the dock, and loop through a 7-ft. piece of sash cord, using snap fasteners at each end. Use a short piece to tie up the rear side of the boat to the dock edge.—CHARLES F. SPRUYENIAN



At the end of the season, the platform is drawn back and the end logs are removed.

ROUTING SHEET METAL

THE routing of flat sheets of metal on the drill press is made much easier by clamping the metal to a board as shown at the left. Three slots are made in the board, as shown, to take three carriage bolts with washers and wing nuts. The slots should be countersunk on the under side. Clamp the metal down by placing an edge of each washer over it and tighten the nuts. The method is used by an engraver for routing zinc plates.—G. S. G.



Tying up a boat in this way saves it from being damaged by pounding against the dock. One rope passes through a pulley on the post.

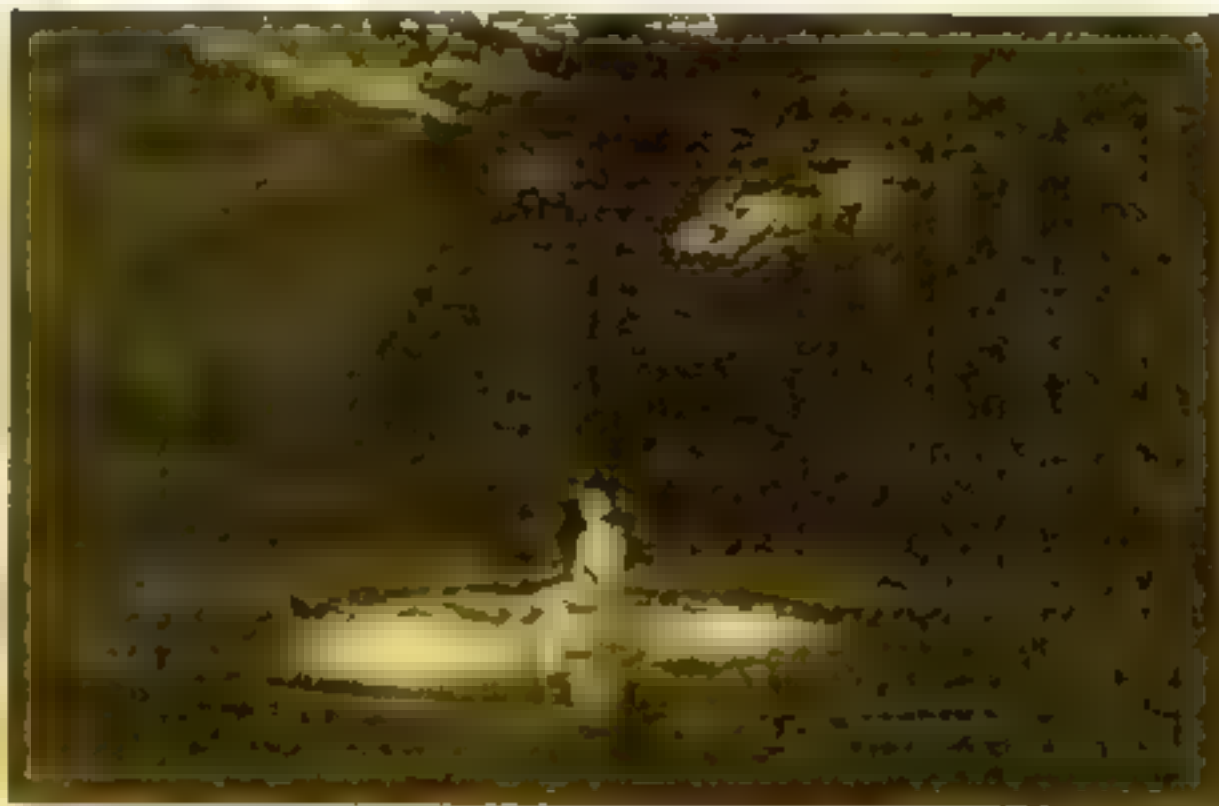
Colored Underwater Lights

Lend
Magic Beauty
to Garden Pools
and Fountains

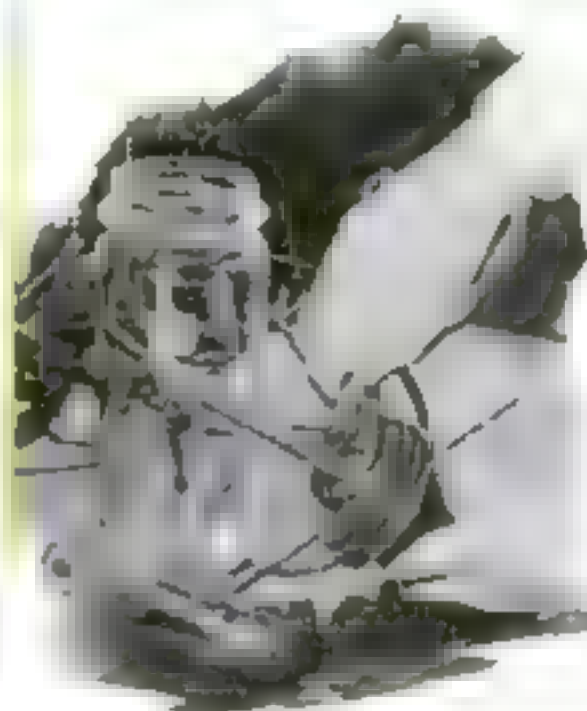
By
WALTER E.
BURTON



An experimental lighting unit made from a glass jar socket and tubular bulb can be submerged in the water of a pool and moved from place to place until the most artistic effect is obtained.



Underwater projectors light this pool on the estate of Paul D. Cravath, Locust Valley, N. Y., and cast a glow on the foliage, while a concealed spotlight illuminates the statue.



THE magic touch of light will transform your garden pool into a jewel that gleams in the darkness with astonishing beauty. Goldfish, plants, and other details of the submarine world that you normally do not see, become a source of endless pleasure. If there is a fountain or miniature waterfall, light will bring out its hidden beauty. A swimming pool, whether indoors or out, will be doubly serviceable if it is equipped with an underwater lighting system.

Waterproof lighting fixtures are now available that can be used in a submerged position indefinitely. If you are planning to light your lily pool, garden fountain, or waterfall, you can experiment, if you wish, with cheap, improvised equipment before investing money in a permanent installation. From a fruit jar that has a tight-fitting lid, a quantity of rubber-covered cable, some metal pipe or tubing, a socket, some pieces of inner tube for gaskets, and

a few other odds and ends, you can construct a lighting unit that can be used in the water.

Obtain a socket that can be mounted inside the lid. A keyless brass socket having a threaded base for receiving a nipple or a piece of conduit pipe will do. The pipe can be long enough to extend above the water surface, or the rubber-covered cable can be sealed inside a 3- or 4-in. nipple with aquarium cement or sealing wax. Use a new fruit-jar rubber to make the lid water-tight. A tubular lamp is best because it will slip into the jar easily.

This fixture, which should not be considered as a substitute for the more serviceable and powerful manufactured ones, will lend itself to an almost endless number of applications. Stick it into a small garden pool, and see how it transforms the underwater world like a magic wand. Place it beneath a fountain, and the light will follow the water as it arches grace-

fully into the air. Lay the jar behind a waterfall, and the light will seem to flow downward with the water.

By using color screens you can produce an endless number of pleasing effects, especially if you have several lighting units. You can buy, from electric stores dealing in show-window equipment, colored transparent material that is virtually heatproof. You can form this into a cylinder and insert it into the jar around the bulb.

A commercial modification of the fruit-jar fixture can be purchased at a moderate price. It consists of a socket mounted on a metal base that is provided with a screw ring for clamping a heavy glass globe over the lamp. The seal between globe and base is made waterproof by gaskets. Conduit or cable connections can be used. The usual lamp size for a small unit of this type is 150 watts.

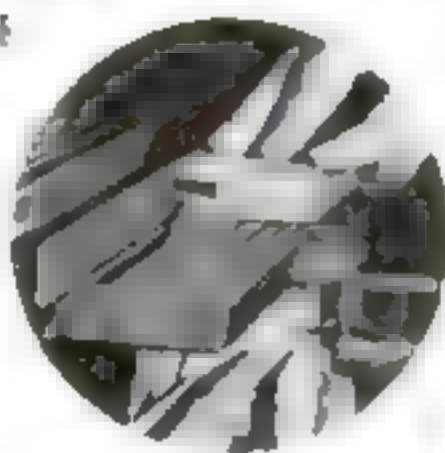
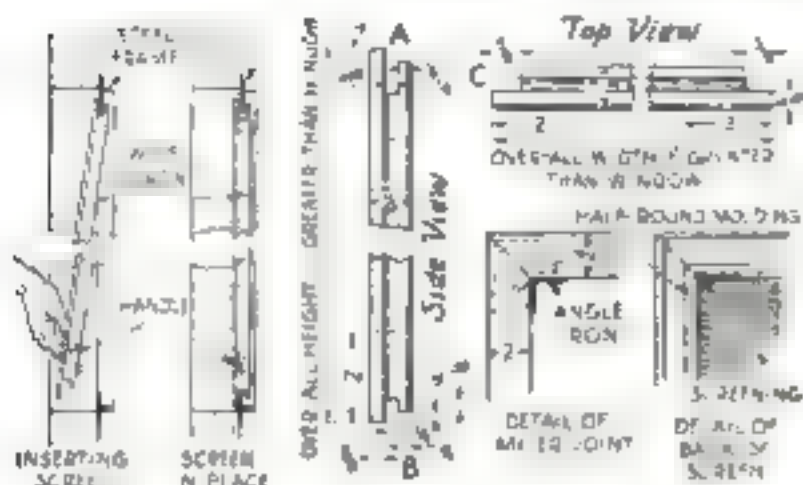
When it comes to lighting large swimming or garden pools, more elaborate equipment is recommended. Several types of underwater units have been designed for lamps ranging in size from 250 to 1,500 watts. Engineers suggest that these fixtures be placed in niches or receptacles built into the walls of the pool where they will be protected from damage and will not be in the way.

It has been found that, to give proper illumination for a swimming pool, there should be 2½ watts of electricity used for each square foot of water surface. Thus a pool 20 by 60 ft. has a surface of 1,200 sq. ft. and requires 3,000 watts. This could be provided by a dozen 250-watt lighting units mounted about 2½ ft. below the surface and spaced equally around the edges.

If you are building a garden pool or waterfall, install a few windows in the concrete walls, behind which lamps can be placed. Build a form the size of the opening desired. (Continued on page 105.)

EASY WAY TO MAKE Screens for Steel Casements

By C. Elmer Black



How the frames are constructed and, above, how the grooved top and bottom pieces are cut back

IN MANY cases, steel casement windows are not provided with adequate screens for the warm months of the year. An exception is the roll type of screen, which is ideal except for its cost. Because casement windows open outward, the ordinary full-length screen on the outside of the window cannot be used.

The inside screen illustrated is simple in construction, easily handled, and inexpensive. For the construction, a small circular saw fitted with a dado head will reduce the labor to a minimum, although the grooves can be worked out with special planes. Clear white pine $\frac{3}{4}$ by 2 in. will be found easiest to work.

Determine the actual inside width and length of the steel frame with the window open. Now make the frame, with mitered joints at the corners, 1 in. greater in

width and length than these dimensions but do not fasten the parts. Mark these pieces to identify them later, especially the top and bottom, and also mark the front faces.

Now set up the dado head for a $\frac{1}{2}$ -in. cut and set the fence $\frac{1}{2}$ in. away. Cut groove A in the top piece with the front face against the fence. Lower the dado head to $\frac{1}{2}$ in. and run groove B in the bottom.

Now reset the dado head for a $\frac{3}{8}$ -in. cut and rabbet the sidepieces as at C. Remove the dado and set up the circular saw for a $\frac{1}{2}$ -in. cut to remove $\frac{1}{2}$ in. from the back of the grooves in the top and bottom pieces. In running these through be sure to rest the back of the piece on the saw table.

The frame is now assembled by using angle irons, or the miter joint can be



The top of the screen is inserted then the bottom is pushed in and dropped into place

glued with an inserted spline. The insect screening is put on in the usual way and the screen is ready for finishing. Use a priming coat followed by two or more coats of enamel to match the woodwork.

To insert the screen in the window hold the bottom in the right hand and use the left to guide the top of the screen until it fits around the steel lip of the frame. Push up with the right hand, then inward until the screen fits flat against the frame. Now let the screen down. A small handle fastened to the bottom rail as shown will aid in removing it.



PICTURE-FRAME CLAMP

TWO inexpensive machinists' vises of the type that can be clamped to the bench may be used in place of a special picture-frame clamp. They are set at right angles on a corner of the workbench as shown above. If adjusted correctly they will hold a picture frame square and rigid while you are gluing and nailing the pieces together.—EDWARD ECKLAND.

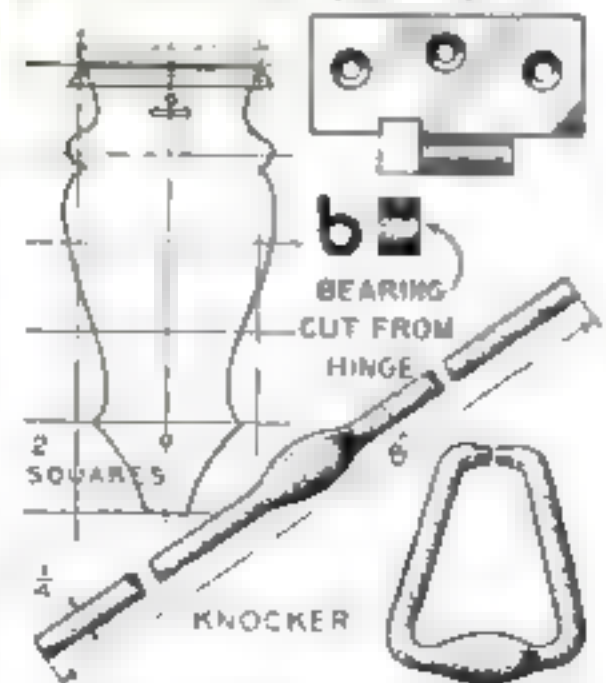
SOLDERING IRON GIVES SIGNAL

BEFORE turning on the switch to heat an electric soldering iron, dip the copper point in soldering paste. When the iron is hot enough to use the paste will commence smoking and thus provide an effective signal.—N. N. E.

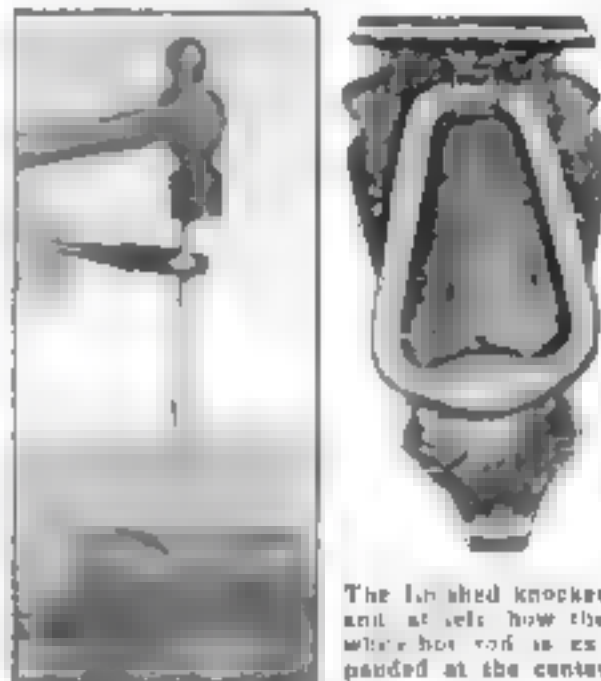
DOOR KNOCKER OF HAND-WROUGHT IRON

WITHOUT any special tools or even a forge, it is possible to make a decorative door knocker that has all the appearance of one hammered out of wrought iron.

The plate for the knocker is made from $1/16$ -in. soft sheet iron and is hammered and shaped while cold. The bearing may be shaped by hand; however a simpler way is to cut one from a half section of an old hinge, as shown. This is riveted into the slot at the top of the plate.



Pattern for the back plate, how the bearing is cut from a hinge and the knocker itself

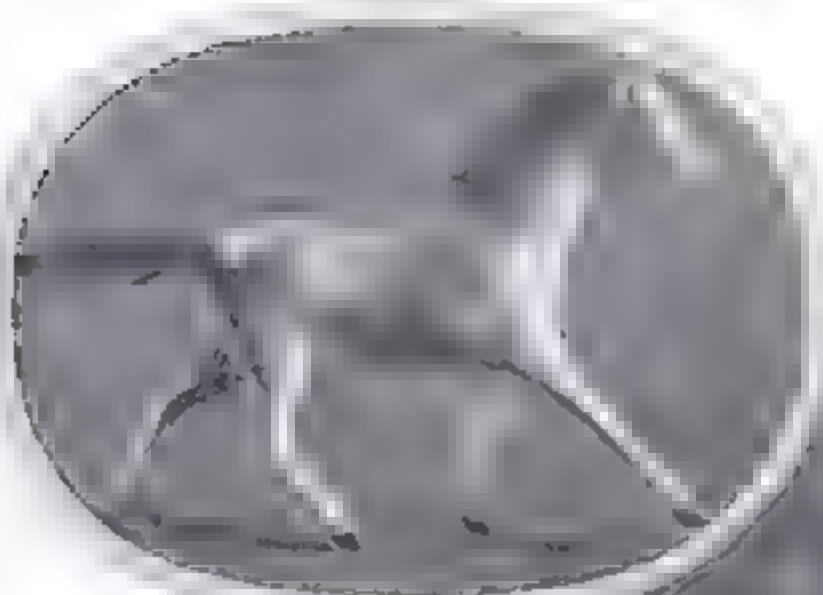


The finished knocker and, at left, how the white-hot rod is expanded at the center

The knocker is a piece of $1/4$ -in. soft round iron 8 in. long. Heat the center of this in any convenient way to a white heat, and holding it upright on an anvil or any steel block, strike down on the end, as illustrated. This will cause the metal to expand where heated. Repeat this until the desired size is obtained. Then heat where the bends are to be made and bend to shape in the vise. Taper the ends down with a file or draw them down with the hammer to fit the bearing readily.—DICK HUTCHINSON.

Carving with Jig-Saw and Sander

BY
EDWARD B.
FOX



It was made by the new jig saw and sander. The author with it is a big success story for his work.

JIG SAW sculpture is the art of making what look like hand-carved animals, birds, and other ornaments with nothing more than a motor-driven jig saw and a disk sander.

Two examples are given—a horse and a squirrel. These have been drawn looking straight ahead for simplicity of construction. As one becomes more expert it is possible to build them up with the head turned, or with a leg stretched out to the side.

The horse is a pacer and requires only three jig-sawed parts. For a model of the size shown, 1 in. thick wood will be satisfactory. White pine, poplar, birch, or basswood give excellent results. The legs will be much stronger if two-ply instead of three-ply is used for the outer sections. Two-ply can be easily made in small pieces with casein glue if a letterpress or other press is available. The center section can be made of three-ply fir or any other inexpensive wood. Fir is mentioned as most plywood manufacturers carry it made up with waterproof glue. If this is not used, dip the finished model in flat varnish, which will help in keeping out dampness.

Make your sketch, divide it into three parts as illustrated, and trace the sections on the wood. For cutting, a No. 3 blade will give good results.

The "carving" is done with fairly coarse sandpaper on a motor-driven circular sander, revolving in a vertical plane. The inside of the horse's legs and ears should be shaped on the sander before any gluing is done.

It is a good idea to drive fine wire nails into the shoulders and thighs of the horse after gluing in order to prevent the sections from slipping out of place when put in the press for two hours or more to dry.



Profit in Selling Jig-Sawed Novelties

When Mr. Fox found his income cut to a minimum by the depression, he released a jig saw. He found a good market for them. It is a profitable business that now of his time. Samples of his work in future issues, drop a line to the Home Workshop Department.



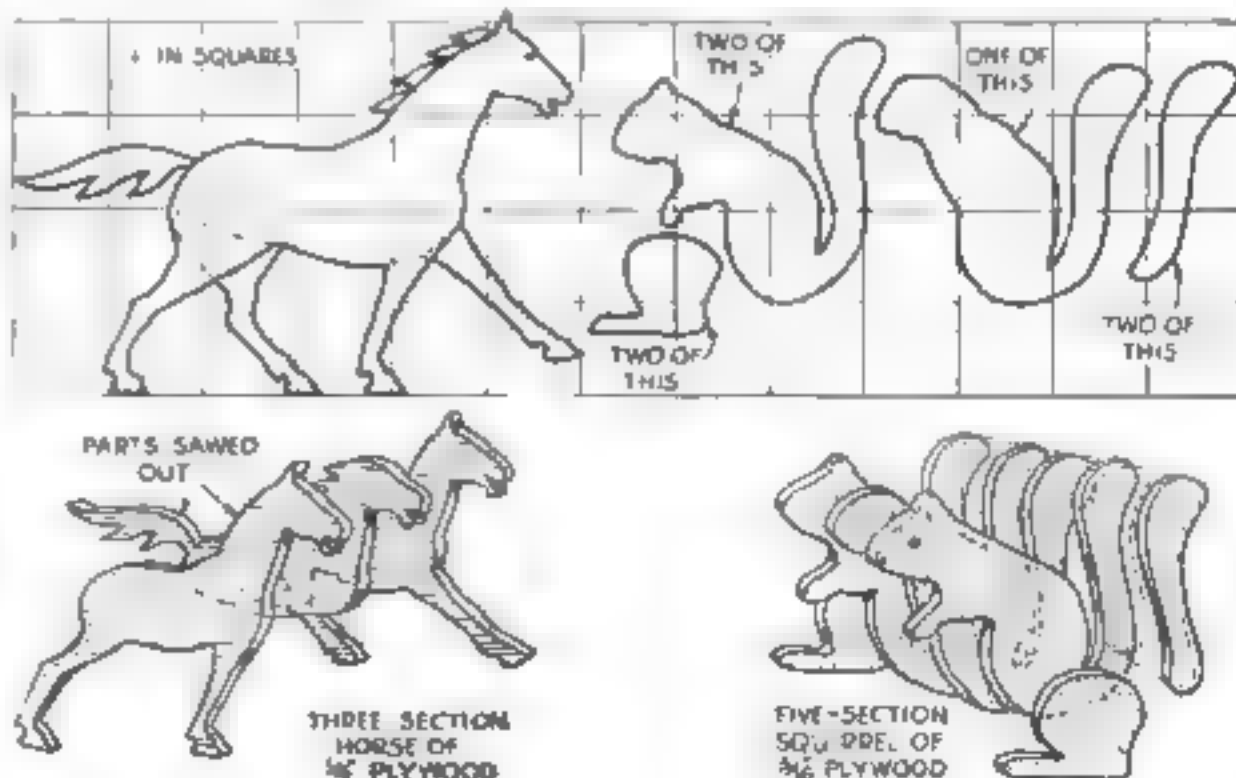
A Novel Way to Sculpture Animals, Birds, Figures, and Other Ornaments

If the nails are driven in part way and the heads are clipped off before sinking them, they will not be seen.

After the glue has set, the horse can be sanded down and shaped. Holes for the eyes are cut with a small gouge, and a still smaller hole is made at their centers. The holes are filled with cellulose household cement, and glass-headed pins are sunk into them after about 1 in. of the steel wire has been capped off. Staining adds the finishing touch.

The squirrel is made in the same manner from 3/16-in. plywood except that there are five sections.

This means may be used to decorate book ends, where half of an animal or small sailboats may be applied. Trays with carved handles and small tables with central ornaments of animals, birds or boats.





Members of the American Tenney Home Workshop Club and some of their craftwork. At right, A. D. W.



OFFICE OF THE NATIONAL HOMESWORKSHOP GUILD
POPULAR SCIENCE MONTHLY

POPULAR SCIENCE MONTHLY *offers*

Medals *to* Guild Craftsmen

TO PROMOTE a nation-wide series of contests in craftsmanship

POPULAR SCIENCE MONTHLY offers to donate sterling silver medals to all the local clubs affiliated with the National Homeworkshop Guild. Each club may hold its own contest in its own way and under its own rules and regulations. No restrictions or conditions are attached to the offer except that a club must have twenty or more members and must hold its contest at the time of, and in connection with, its annual exhibition next winter.

The medals will be of unusual beauty

Prizes will be donated to home workshop clubs so they can reward best work of their members

and value. Struck from a special die, they will bear the insignia of the National Homeworkshop Guild and an appropriate inscription. Their design will be such that they can either be worn as a watch charm or mounted on a neat wooden plaque and hung on the wall.

This is the greatest series of awards for home craftsmanship ever made in respect both to its general scope and its significance. It has been made possible only because the amateur craftsmen of the United

States now have, for the first time, a strong central organization in the National Homeworkshop Guild. Awarded under such auspices, the medals will represent the highest honor that can come to any amateur craftsman.

Suggestions for conducting the contests will be given in future issues and in the Guild bulletins.

Every local club, of course, will wish to share in this celebration. Begin making your plans now. (Continued on page 50)



Can You Match This Home Workshop?

LEVERN T. KYDER, president of the National Homeworkshop Guild, is proud of his shop. He would like to think it is the best in the Guild, but some of the letters he has received from local homeworkshop clubs have referred to shops that apparently are still larger and better equipped. If anyone in your club has such a shop, have it photographed with the owner at work in it, and send a clear print to the Guild Editor, POPULAR SCIENCE MONTHLY, 331 Fourth Avenue, New York, N. Y. The best photographs will be published. Also send any other good prints of general interest that illustrate the work of the club—views similar in type to those at the head of the page. There is probably at least one thoroughly experienced amateur photographer in your club who can do work of professional quality.

NEON TUBE EXPERIMENTS

*Weird Stunts Performed
with Simple Apparatus*

By
**WALTER
BACH**

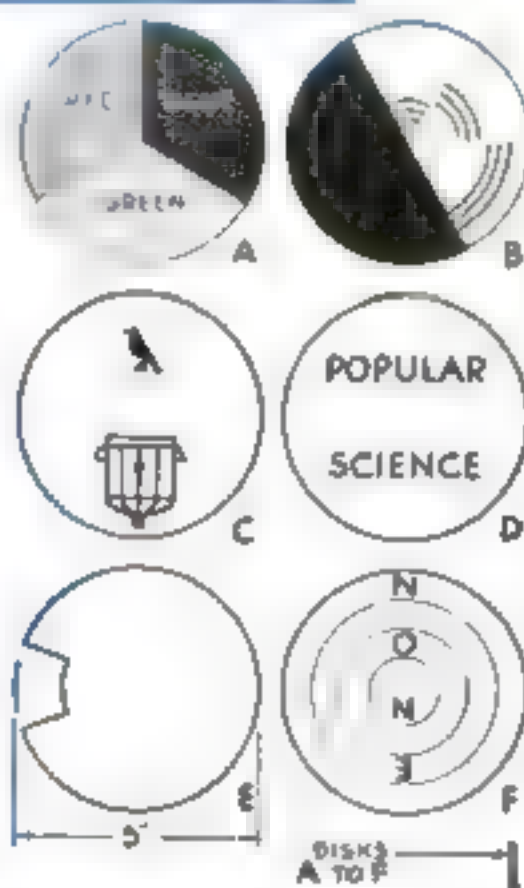
THE hand is said to be quicker than the eye, but a neon tube holds the real prize for speed. It can flicker on and off a hundred times while the eye blinks once! Because of this peculiar ability, many amazing experiments can be performed with it at practically no cost. A few of them will be described together with a home-built circuit breaker with which to do them. A storage battery or any other source of A. C. or D. C. current of from 6 to 12 volts may be used.

To illustrate how the apparatus works, a disk (A), consisting of the three fundamental colors, red, green and blue, is attached to the shaft of apparatus. When it starts to spin the colors vanish and the disk looks white, but in the fluctuating glow of the neon tube the colors become distinct and visible again and the entire apparatus seems to stand still although it is really spinning rapidly.

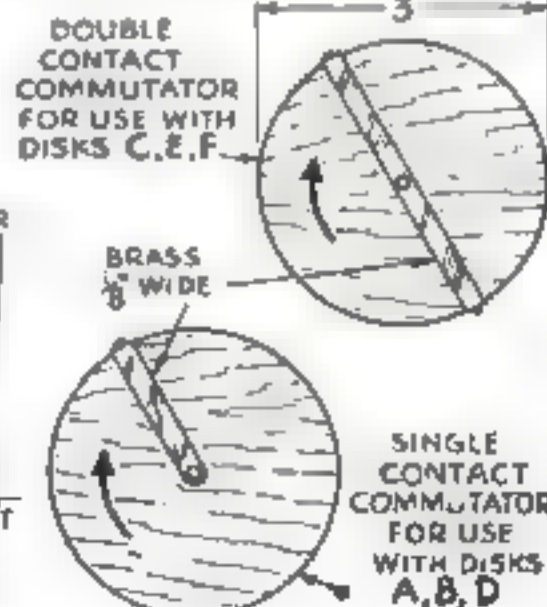
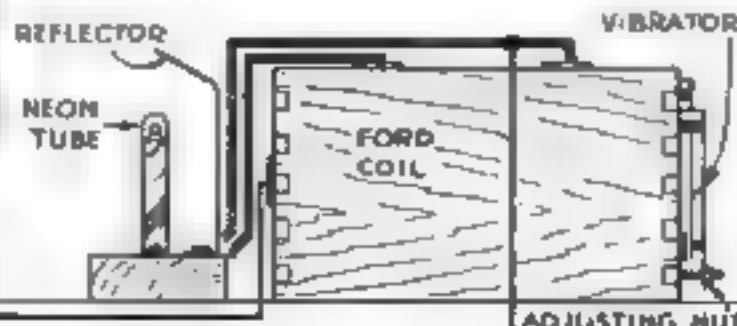
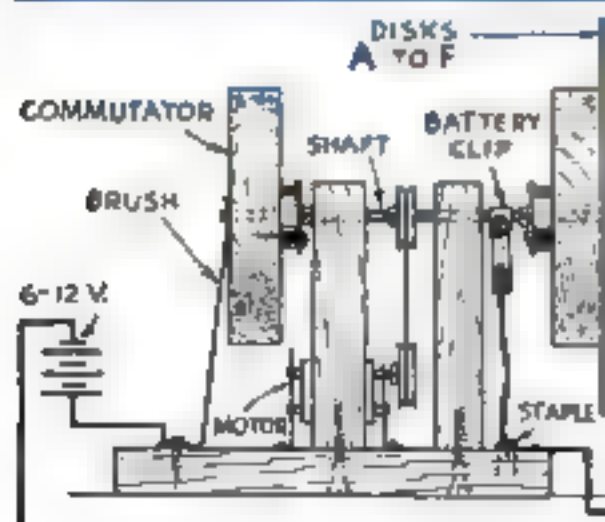
The details of construction are clearly shown and are for the most part self-explanatory. Run the apparatus at medium speed for best results. By using a toy-train



An ordinary spark-plug tester furnishes the neon tube. It should be carefully removed and mounted on a base as a wooden base as shown at the left. The reflector should not be placed too close to the neon tube itself.



See disk designs. If a double-contact commutator is used with C, two cages are seen, each containing a bird. The words on D become distinct when the neon tube lights up. Viewing the tube through E is a queer sight.



A toy construction set supplied the original parts. The base is $\frac{1}{2}$ by 6 by 8 in., the uprights are $\frac{3}{8}$ by 2 by $\frac{3}{4}$ in. The brush is of spring brass. Note that the shaft itself forms a part of the circuit.

Dog Leashes and Watch Guards

MADE BY TYING SIMPLE SQUARE KNOTS



Boy Scouts will find this method of tying square knots

Same method used for Boy Scout watch guards and lanyards



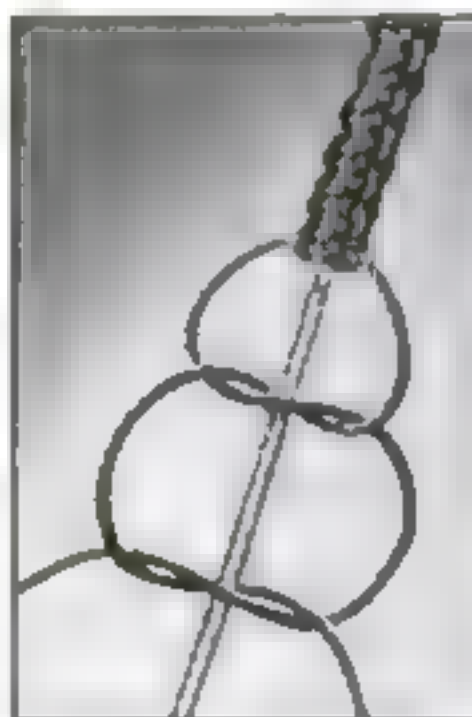
Watch guard made by tying square knots

By
**KENNETH
MURRAY**

MANY practical and attractive articles can be made merely by tying knots in lengths of cord. Readers who have not worked out any of the previous projects in our knot-work series may commence now with one or more of the designs shown on this page and on page 94. They have been especially selected for ease in making. In fact, anyone can do this simple variety of knot work with complete assurance of success. It will then be possible to branch out into more complicated designs and make such projects as belts, silk purs for window shades and lamps, men's ties, bath-robe cords, cigarette cases, and key cases. Articles about all of these have been published in past issues; see the list at the end of this article.

The cord should be strong and of about the size of a mechanical pencil lead. It can be obtained in department stores everywhere, and is also made in a variety of colors especially for use in knot work.

The lanyard and dog leash are made of narrow knotted strips, pliable yet very strong. Two methods of knotting will be described. The first, which gives a narrow strip, is shown in the center of this page. Tie the two cords to the back of a chair or fasten them with a pushpin to the edge of a table. To hold them taut, these "filler cords," as they are called, are caught in a hook fastened to the chest. This consists of a small wood block with screw eyes in either end to which is tied a cord passing around the body several inches above the belt line. A nail is driven through the block with its point turned back on itself to form a hook. The way in which this hook is used is illustrated in the upper right-hand photograph on this page.



A narrow strip is knotted by tying a series of square knots around two taut filler cords. The narrow part of watch guard is thus made

After bucking the filler cords, another cord is picked up at the middle and tied around the filler cords as close as possible to the chair or table. A simple square knot is used. Draw up the knot tightly and then make a succession of the same kind of knots around the two filler cords as shown, until the strip is sufficient in length.

A wider and different kind of strip is shown on page 94, but it is made with the same kind of knots. In this case fasten the ends of six cords to the table. Take four of the cords on the left (allowing the two on the right to fall loose) and fasten the two middle ones to the hook. With the two outside cords of the set of four make a square knot over the two on the



hook. Drop the four cords and take the four on the right, again allowing the two on the left to hang loose. Make the knot as before and return to the four cords on the left. This is continued back and forth. Draw each knot up tightly against the previous ones.

For making both the lanyard and dog leash, the narrower strip seems the better type to use. The lanyard requires two filler cords cut about a foot longer than you

wish the strip to be (between 3 and 4 ft.). Cut the tying cord, preferably in a contrasting color nine times as long. Knotting is, of course, started in the middle. The leash is made in the same way but about 5 ft. long, and for additional strength use four or six filler cords.

The strips are ended with loops by bending the end back on itself and tying the loose cord ends about the joint securely. At one end the loop is made around the body of the strip to provide a sliding loop for use around the neck in the case of the lanyard, and around the wrist for the leash. Loops on the other ends secure the lanyard whistle and leash snap, respectively.

The next and following on page 94

Cushioned Back Pack

LIGHTENS A HIKER'S BURDEN

By
Jack Van Couvering



Upper left: Ready for fitting trip. In rectangle: Back view with crosspieces on floor. Above: Pack upside down. In circle: Shoulder straps in place.

pieces can be seen lying on the floor in one of the illustrations. All the crosspieces are cut 13/4 in. between the frame and are 14 in. over all, allowing 3/4 in. for the projections which fit into the side frames. No screws or nails are used for this purpose.

The canvas covering is made from 12-oz. duck, as are the backstraps, which are fastened as shown. Tent eyelets are used for the lacing. Brass or copper hardware is used, rather than iron, to obviate rusting.

The most practical finish for the wood is to rub it with unseed oil. For fastening the shoulder straps to the lower end of the frame, either leather or cotton lacing may be used. Note the hole cut in the top center of the canvas to permit the shoulder straps to pass through so they can be fastened securely to the cross brace.

To get the pack ready for use, lace up the canvas all the way to form the cushion which rests

against your back. Then lay your duffle on top of the canvas, and strap it across with a length of lightweight sashcord catching the cord on the hooks on the side frames. For this you will need at least 30 ft. of cord. The tops of the side frames are left pointed so that an auxiliary duffle bag may be hung over these, when desired. When you go on a hike, put on the pack as you would a coat, adjust it well up on your shoulders, and you're ready to travel. It will make your burden seem much lighter.

WITH an Alaskan back pack you can carry forty-five or fifty pounds over the worst kind of wilderness trails with no more effort than a roll of bedding. The pack is made of wood and canvas, which

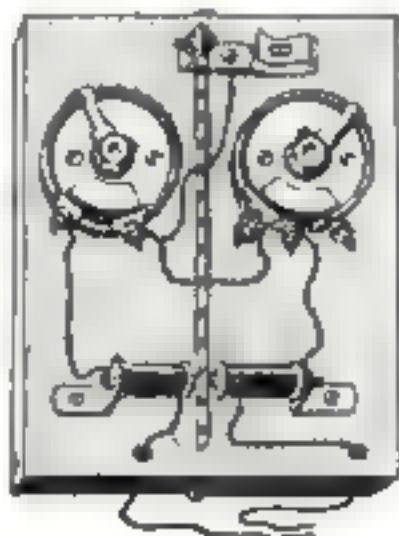
will cushion the load against your back.

First cut two pieces for the outside frame. The sides are 31 in. long, 3 1/2 in. wide at the bottom, 2 1/2 in. wide at the top, and shaped as shown in the photograph. Four crosspieces are mortised into the sidepieces. The top crosspiece is round, cut down from 1-in. stock. The second is cut half-round from 1-in. stock, and the straps that go over the shoulders are fastened to it. The third and fourth crosspieces are shaped to enable the canvas to cushion into the back. These two

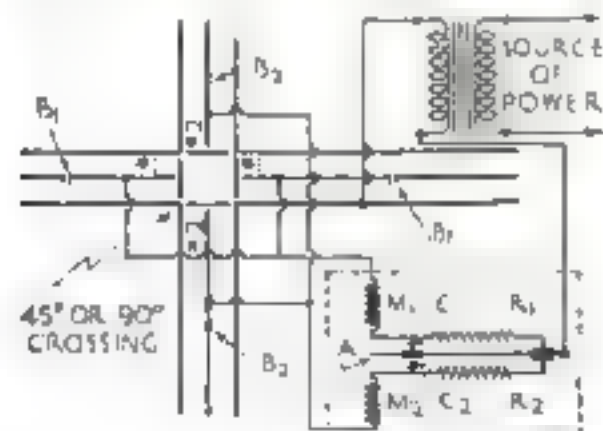
RELAY STOPS SMASH-UPS ON MODEL RAILWAY

Locomotives and cars often are seriously damaged by collisions at the crossings of a model railroad. Various methods of preventing such accidents have been described before, but another excellent one is to install relay switches like that illustrated. The diagram looks a bit complicated, but is really quite simple. The third rail on each side of the crossing in one direction is supplied with current through a resistance and a small magnet connected in series. The current for the third rail in the other direction is supplied through another magnet and resistance.

The two magnets M_1 and M_2 are made of small stove bolts wound with No. 22



The rheostats of the relay are adjusted so that enough current flows to cause the magnet to pull over the contact arm, but not sufficient to operate locomotive.



insulated wire. The resistances R_1 and R_2 are ordinary old-style radio rheostats obtained from the junk box of a radio shop. The third rails are marked 1 and 2, and the breaker points, B_1 and B_2 .

The rheostats are set so that the current flow is just enough to cause the magnet to pull over the contact arm A , but not enough to operate the locomotive. When a locomotive approaches and runs onto the section of track supplied through either one of the magnets, it slows down

then the current flow pulls the contact shorting the resistance, and the train proceeds over the crossing. If a locomotive approaches from the other direction, it cannot pull over the contact because it is already held in the opposite position.

If two trains should happen to reach the crossing at the same instant, then the one which happened to draw the most current would pull the relay arm over to its side, and the other train would have to wait. RICHARD CANFIELD

QUICK NEW WAY TO CONSTRUCT

Small Ship

For models of this simple type any table will serve as a bench. The only tools needed are razor blades, pliers, ruler, and brushes.

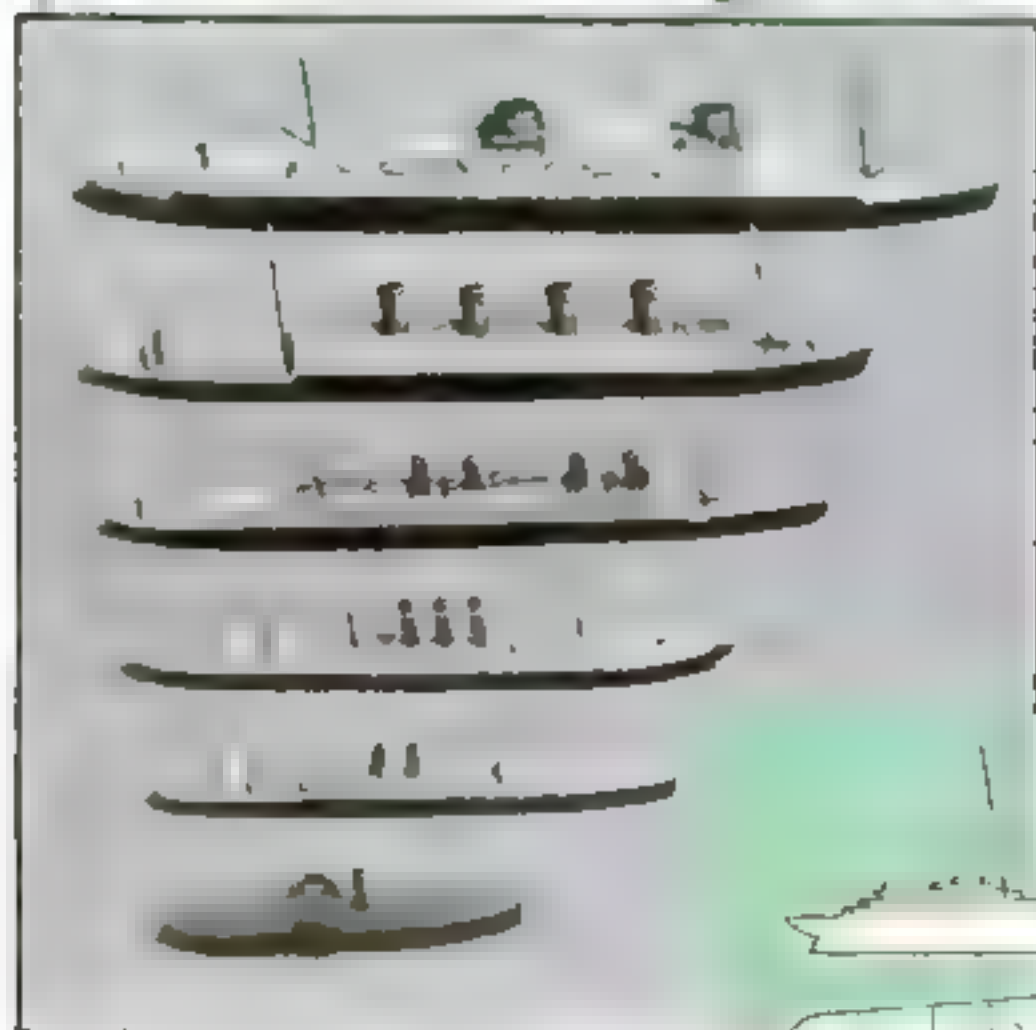
MAKING miniature ship models in sets is a fascinating hobby. It does not require the time, the tools, the materials, or the skill needed to construct a large scale model. In fact, if you use the novel layer-by-layer method illustrated, you will find the work is comparatively simple and that all the usual difficulties of painting a model are eliminated. When you have completed a series of miniature models, all to the same scale, you will have something that is in many respects more interesting and informative for exhibition purposes than a single elaborate model.

In this way you can make related groups of models to illustrate any period in the history of the sea or in the development of ships that happens to appeal to you. For example, a set of models can be built to show the growth of the steamship from early paddler to newest giant, or the various types now used in the merchant marine. If you prefer warships, you can take a portion of the fleet, such as the cruiser squadron of the United States Navy, or examples of the various types of ships now used in the navy, or a collection to illustrate the development of battleships from the Revolution to the World War.

These miniatures do not have to contain great detail in order to appear complete. In fact, it is more important in work of this type to know what to leave out than what to put in. Such details as winches, davits, and ratings are not essential. On the other hand, the model must reproduce with perfect accuracy the outline and mass effect of hull and superstructure. For this, accurate plans are necessary, and nothing less than the actual plans of the prototype should be used, difficult though it may be, at times, to obtain them. Finally, correct coloring, neatly done, is very important. By constructing each section that requires a different color as a separate unit and assembling these units after they have been painted, this difficulty can be overcome.

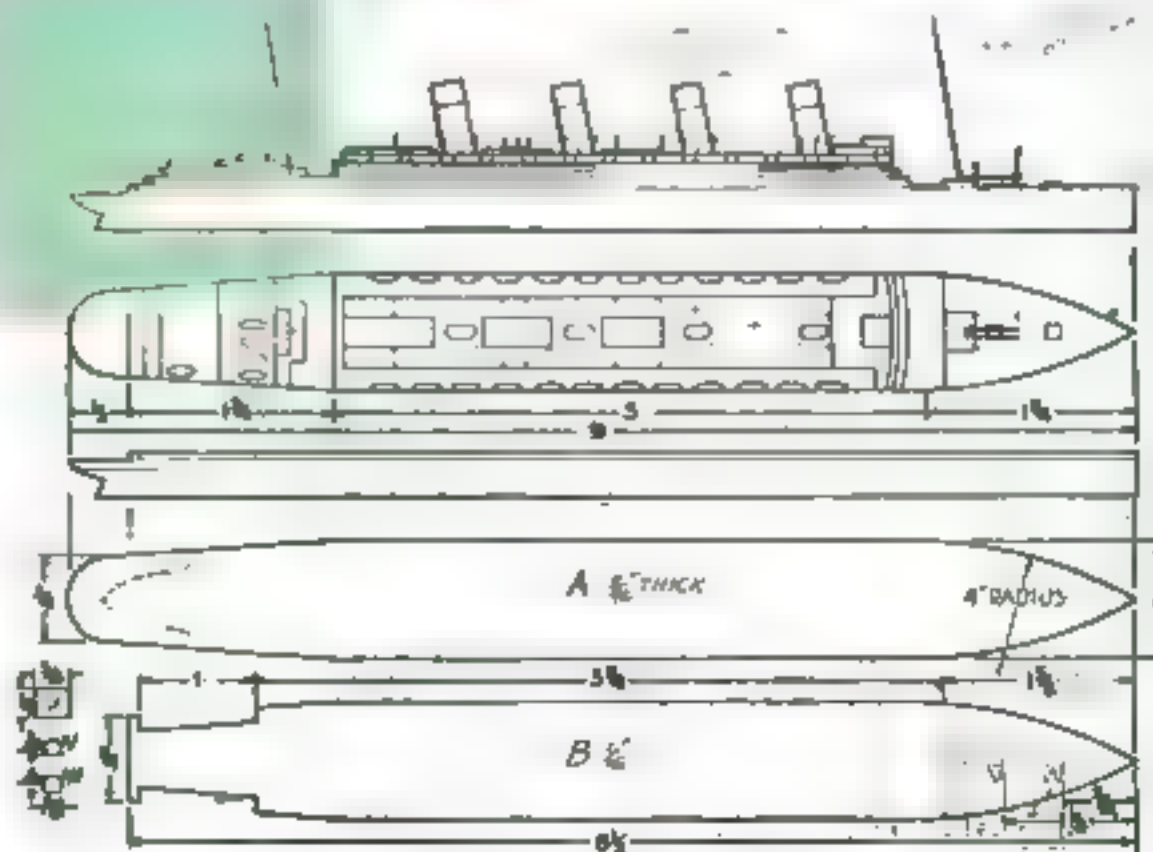
The accompanying plans for a model of the Cun-

The drawings below and on the facing page are for a 1/16" model of the *Aquitania*. The parts are cut with a razor blade from balsa wood of the type used for making model airplanes. The same scale is used for all the drawings.



Big record breakers—*Bremen*, *Mauritania*, *Deutschland*, *City of Paris*, *Britannia*, *Pacific*

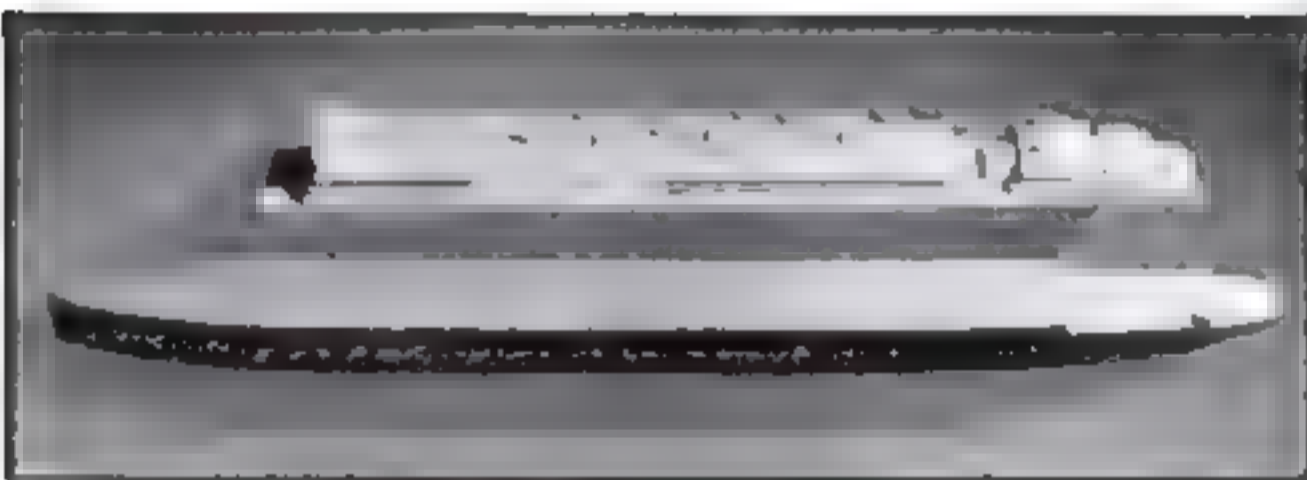
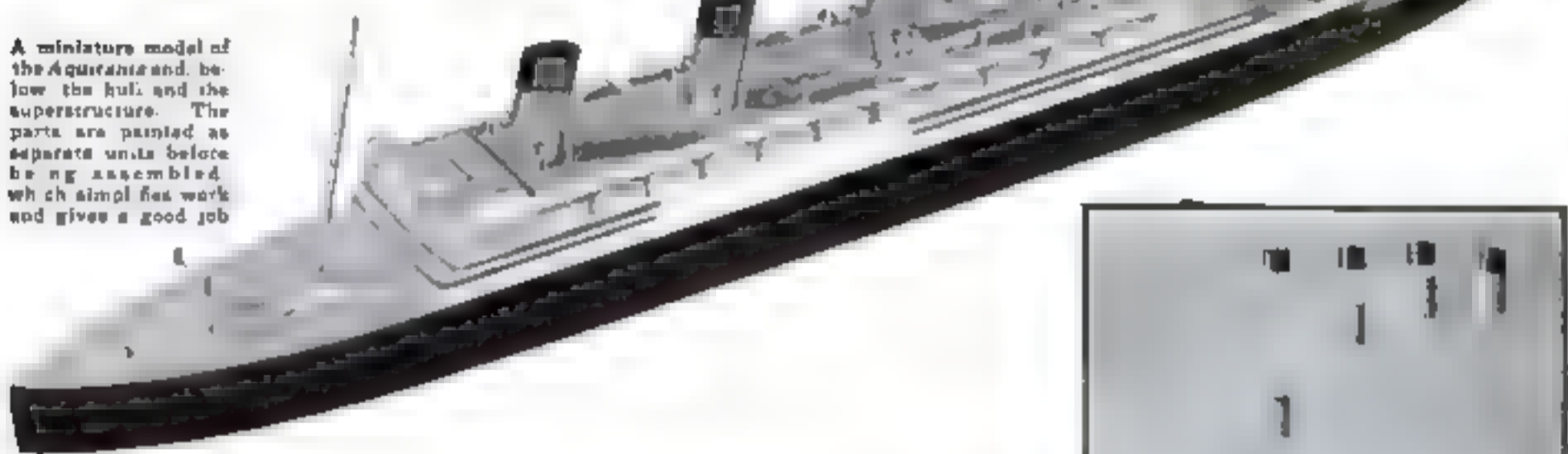
Parts are cut from thin balsa wood and put together layer by layer . . .
Model of liner *Aquitania* illustrates method



Models *in* Sets

By THEODORE GOMMI

A miniature model of the *Aquitania* and, below the hull and the superstructure. The parts are painted as separate units before being assembled, which simplifies work and gives a good job.



Funnels are made in one piece, then cut in two, painted, and reassembled. Pins serve as masts, ventilators, and derrick booms.

order *Aquitania* to the scale of 1 in. equals 100 ft. will show what can be done on these principles. Though nearly twenty years old the *Aquitania* is still one of the largest and fastest vessels on the Atlantic. Her graceful lines and majestic proportions—to say nothing of her four funnels—make her, in the opinion of many,

the most beautiful steamship afloat.

The model is constructed on the familiar "bread and butter" principle: balsa sheets of various thicknesses forming the layers. Pins, glue, and paint (colored model airplane "dope") specified in the list of materials, are the only other materials needed. All these are obtainable from dealers in model airplane supplies.

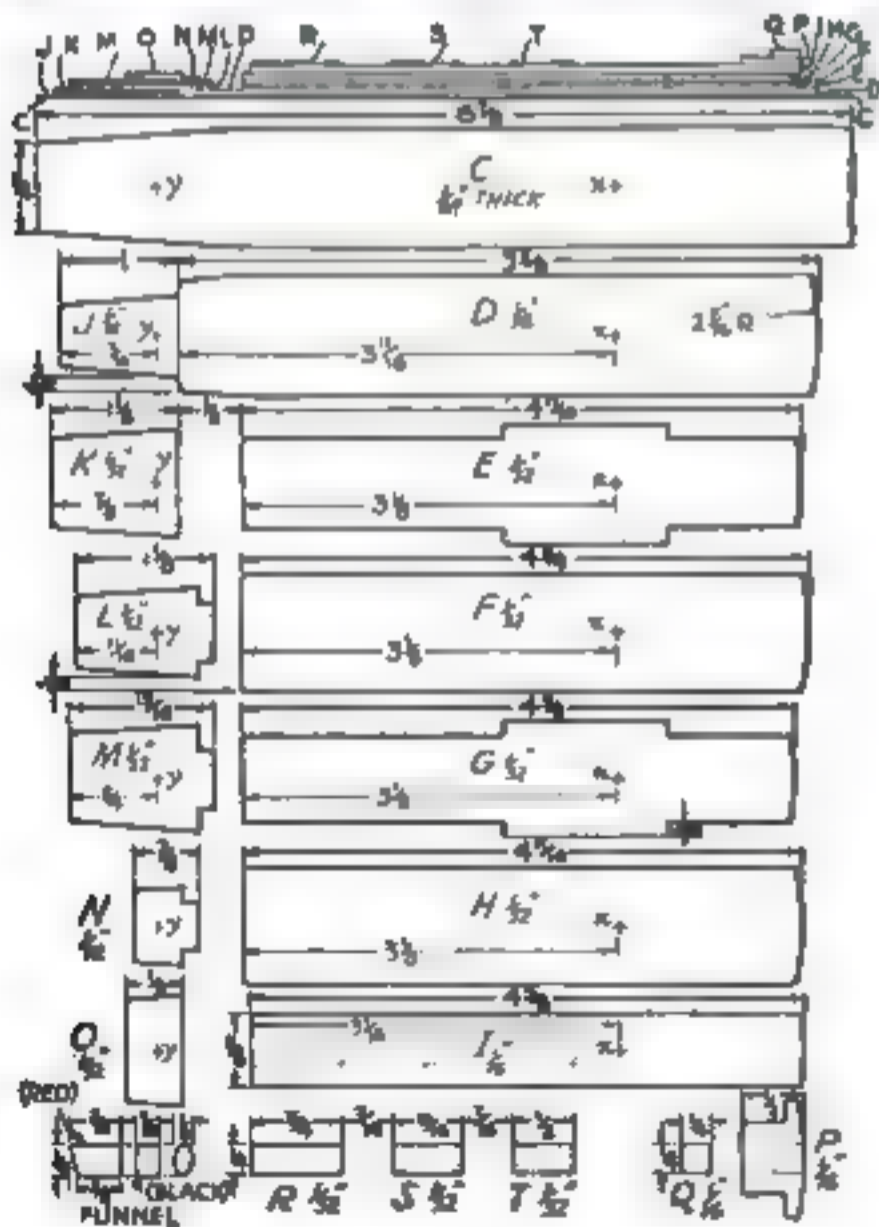
Make a full-size cardboard pattern of piece A. This can be accurately done with ruler and compass. The bow (1 1/4 in. long) is 1 in. wide and shaped by two arcs of 4-in. radius. The center section is an oblong 1 by 5 in. and a trapezoid of 1 1/4 in. altitude with bases of 1 and 3/4 in. respectively. A semicircle of 3/8 in. radius forms the stern.

Cut all wood to the sizes specified. Using the cardboard pattern, shape piece A into a blank. Carve the stern to shape shown. Cut piece B and glue it to A. Paint the bottom and sides black, but leave the upper side unpainted.

Make the superstructure unit by cutting pieces C to T. Pieces C to I are all based on oblongs of identical width and varying lengths and are not difficult to measure. Pieces J to O, however, are based on the trapezoid mentioned in making the pattern and it is therefore impossible to give any dimensions other than the altitudes in accurately measurable terms. Simply slip each piece under the pattern at the proper place and cut it to match the pattern. Pieces J, L, and N, must then have 1/8 in. removed from each side.

Locate points x and y on all these pieces. These points are on the center line; the plans give the distances from the end of each piece. Making all points x coincide, glue D to C, E to D, and so on. Then, with all points y coinciding, glue J to C, K to J, and so on. By passing points x through one pin and points y through another, the proper stacking of the layers is assured. And to I pieces P, Q, R, S, and T, measuring the distances carefully.

Make thirty-two lifeboats from 1/16 by 1/4 in. balsa. Sandpaper the corners of the stick to shape, mark 1/16-in. spaces along the length of the stick, and cut the boats, as if slicing bread, with a sharp, thin razor. Glue (Continued on page 104)



Comical Coconut Bird

SERVES AS AN ASH TRAY

THIS funny-looking long-legged tropical bird is one of the best smile-provokers you could have in your home or office. The coconut shell serves as an ash tray.

Take off the outer husk of a coconut, drain the milk by punching in the center indentation in the end of the nut, then wire-brush the shell. Saw a slice off the top of the nut to make the large opening, and drill the three leg and neck holes. Enlarge them

to about $\frac{3}{8}$ in. with a tapered reamer or a three-cornered file, and keep fitting the legs, which are $\frac{3}{8}$ -in. dowels, so they will be very tight. No glue is used. The longest piece, which is 30 in., serves as the neck as well as one leg. The short dowel is $25\frac{1}{2}$ in. long.

The base is $8\frac{1}{2}$ in. in diameter and 1 in. thick. One hole is drilled in the center and the other 2 in. from the edge. The feet are eight pieces of $\frac{1}{4}$ -in. dowseling cut $1\frac{1}{2}$ in. long and fastened to the base with $\frac{1}{2}$ -in. No. 20 brads. Drive the legs into the base before fastening the feet. The longest one goes in the center of the base.

The head is cut out of a piece of scrap wood from 1 to $1\frac{1}{4}$ in. thick, or, if you wish, you can use a darning egg instead. Bore two $\frac{1}{8}$ -in. holes in the head, one for the topknot and the other for the neck. The tail and topknot are made from pipe cleaners. Use colored cleaners if you can get them, or dye white ones red. The topknot consists of four pipe cleaners cut in half and doubled; the tail is made from ten or more cleaners bent double, pushed in the hole in the end of the nut, and wrapped with an extra cleaner inside the nut.

An orange head and body trimmed with black, a red topknot and tail, black legs, knee joints indicated with a touch of orange, black feet with orange nails on a green base mottled with orange—this color scheme makes an attractive bird.

After the enamel or lacquer is dry, put some sand in the shell for smothering cigarettes, and your "Gogo-bird" is ready to take his appointed place anywhere in the family picture.—CHARLES H. ADLER.

You could hunt in vain through the jungle to find a mate for this cur-ous bird. He doesn't fly and has no song but he has a real purpose nevertheless—to hold cigarette butts and ashes.



All you need to make the bird besides the coconut are two sizes of wooden dowels, a spool of wood for the base and head, pipe cleaners, and orange, black and green enamel.

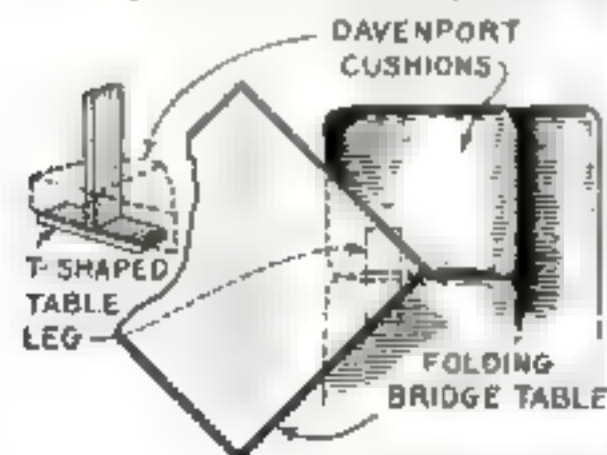


DAVENPORT HELPS OUT AT CARD PARTY

HAVE you ever had a bridge party in your apartment or home and found that after setting up the bridge tables, there was little room to walk around? And how often has it been necessary to run out to the neighbors to borrow extra chairs?

This is all unnecessary if you fix one of the tables as illustrated. Two of the card players can then sit on the davenport, and the table itself will not take up so much of the floor space. To use a table in this manner leave one of the legs folded under, and substitute a short support made as shown in the drawing from 1 by 2 or 1 by 3 in. stock. Use one piece about

12 in. long for the base and cut the upright piece to correspond to the distance between the underside of the card table and the top of the davenport framework. Nail these pieces together. This substitute leg is not fastened to the table yet it will not fall because it is placed between two of the seat cushions.—J. P. KETTER.



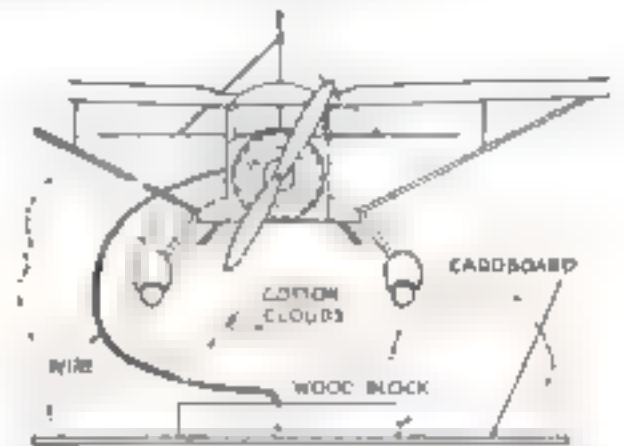
SUET HOLDER FOR BIRDS

A SUET holder for feeding birds can be made from an old wire soap dish. After the hangers have been removed, the dish is mounted on a board by means of two staples, which also serve as a hinge so that the contents may be replaced when necessary. The hanger is painted white and fastened to a tree near a bird-feeding platform. The wire bars provide a perch for the birds and prevent their carrying large pieces of suet away as they would otherwise do.—DANIEL REYNOLDS.

Whittled Model of a Racy Cabin Monoplane

The 1934 Stinson Reliant

By
Donald
W.
Clark



A suggestion for mounting the model with fluffy cotton under it to represent clouds

Setting up the finished model on a wood and cardboard base with a cloud effect of cotton

IF YOU want to add an up-to-the-minute model to your collection of solid model airplanes, here is one of the latest—the new 1934 Stinson Reliant, a trim four-passenger cabin monoplane. Fully streamlined and neatly trimmed, it is a beautiful ship. The wing span is 41 ft., the length 26 ft. 10 in., and the height 8 ft. 5 in. The model, like its predecessors in this series, is built on the scale of $\frac{1}{4}$ in. equals 1 ft. The drawings, of course, are smaller, but you can easily lay out the parts by using the scale.

The model requires only twenty-two main parts. If the wing-strut braces, valve covers, and other small pieces are counted, there are still but few more than fifty parts. So carefully has the construction been simplified.

The fuselage is made as shown in the detail drawings. The motor cowling can be turned on a lathe or carved from balsa wood by hand. It is held in place with a single nail. The wing roots or stubs and the wheel-strut supports are fastened with glue cement or pins. The wheel struts and pants are attached with both glue and pins.

The best way to make the wings is to shape them in one piece and cut them apart afterwards. The inner ends should be curved and "gulled" to fit against the wing stubs. The wing struts are merely glued in place.

In making the tail units, the usual method of construction is followed, and the forward corners are curved.

Paint the entire model with a coat of flat white paint and follow with light blue four-hour enamel on the fuselage and silver on the wing. Draw the trim designs on paper, blacken the back of the paper with a soft lead pencil, lay the paper against the model, and transfer the designs. Paint the trim with black enamel.



Side, top, and front views of the assembled model, and details of the fuselage, motor cowling, wing, tail units, struts, landing gear, and other parts. To find the dimensions, use the scale

Vacation Picture Books

*... A Better Way to Display Your Photos
Than by Pasting Them in an Ordinary Album*

BY MORTON BARTLETT



Making up the dummy for a vacation book. Rough prints are first made of all the views, and masks are prepared with openings of various sizes. The prints are then pasted on the dummy to agree with the mask openings.

The same masks, as shown below, are used for the actual printing. Care must be taken, of course, that the unused openings in the mask are covered with lightproof paper.



HAVE you ever been bored by people who trundle out batches of loose photographs and exhibit them with verbal captions? And haven't you even wished there were some more workmanlike method of displaying your own vacation or travel pictures than the conventional album? A real book, in which the pictures are photographically printed on pages of sensitized paper—not merely mounted on black album pages—is an excellent answer to this problem. It requires only a little patient puttering, and then you will have a book that will appeal to your friends and deserve their admiration.

A dummy is essential as a preliminary layout for the book. Have at hand for its preparation the following:

1. A set of masks to be used in the actual printing. Each mask is exactly full-page size (for example, 8 by 10 in.) and has cut in it openings of whatever shapes and sizes will best display your pictures. Any of the openings, except those which are centered, may be used in any one of four ways by turning the mask over or upside down, or both. Several openings may be cut in one mask as a matter of economy. Each mask is numbered, and each opening marked by a letter boldly written beside it.

2. A contact print of each picture. Because they will be pasted on the dummy, these can be made crudely without borders. On the back of each print is written the negative number, and, if the negatives are not uniform in contrast, the grade of paper on which it should be printed.

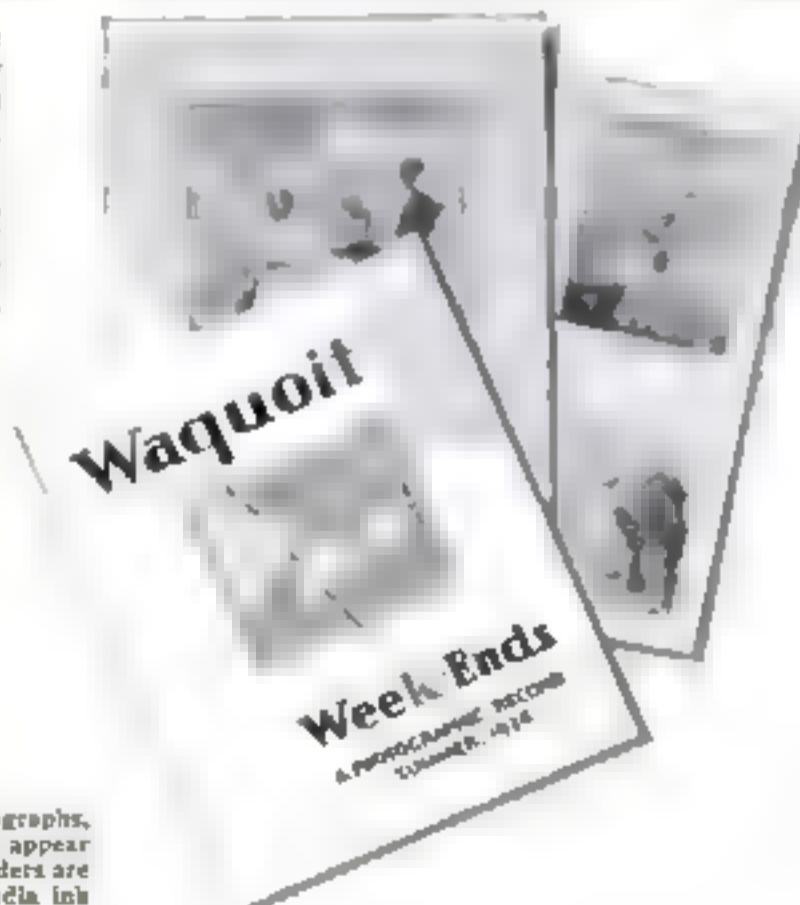
On the finished pages the photographs, like the best exhibition work, appear on a white background. The borders are neatly ruled with waterproof India ink.

3. A quantity of cheap paper cut to full-page size, paste, and a pencil.

Arrange the prints in their approximate sequence. Sheet one of the dummy represents the cover. If you want a photo on it, paste the print on, copying under it the negative number and paper grade. Sheet two is the "fly" and should be left blank. Sheet three is the title-page. Indicate roughly the lettering and whatever photo or design you may want on it. Sheet four is page one of the book. With blanks for three pages before you

place on them in their approximate positions the photos which will appear on them, checking the grade of printing paper called for. When the arrangement of the photos has been roughly determined, set pages two and three aside and work up page one with the masks, removing the prints momentarily but remembering their positions.

The mask is placed on the sheet and the opening for the particular print traced around with the pencil, care being taken that the pencil does not quite touch the edges of the opening lest it be spoiled for its ultimate use in printing. Remove the mask and paste the proper picture within the drawn area. Make a note under it something like this: 5B1R 28.3. Five is the number of the mask used, B indicates the particular opening, U means the mask will be upside down in the frame, R that it is reversed, or turned over. These notes will make it easier to prevent mistakes when you find yourself working "blind" on development. (Continued on page 107)



This 1934 Kodak shows how greatly cameras have improved

The New Kodak Six-20 with f.6.3 lens

EXPECT a lot more of a Kodak now—witness this new 1934 Kodak Six-20, the latest in Kodaks... sums up years of camera development.

Press a button—the camera springs into full picture-taking position, ready for action. Sight through the eye-level finder... follow the action... stop it with a shutter that splits a second into 1/100. Your keen Kodak Anastigmat f.6.3 lens frees you from many light handicaps.

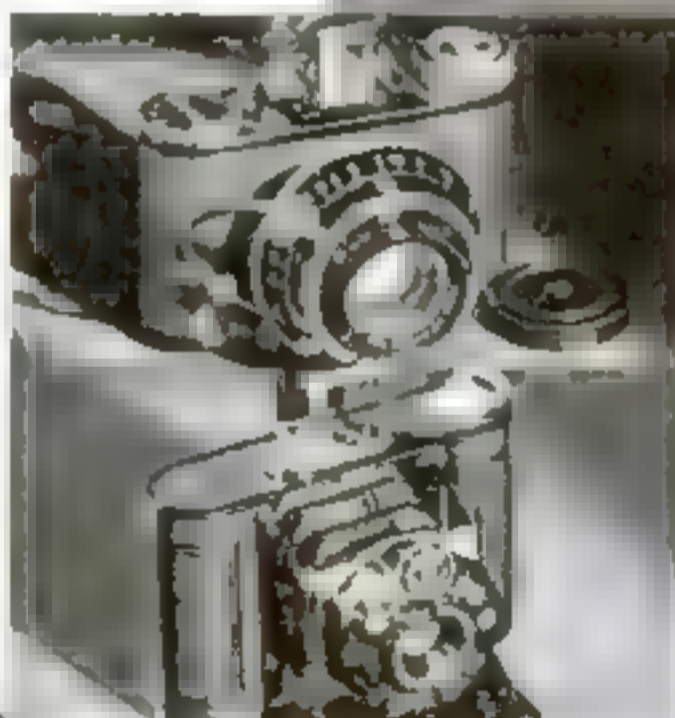
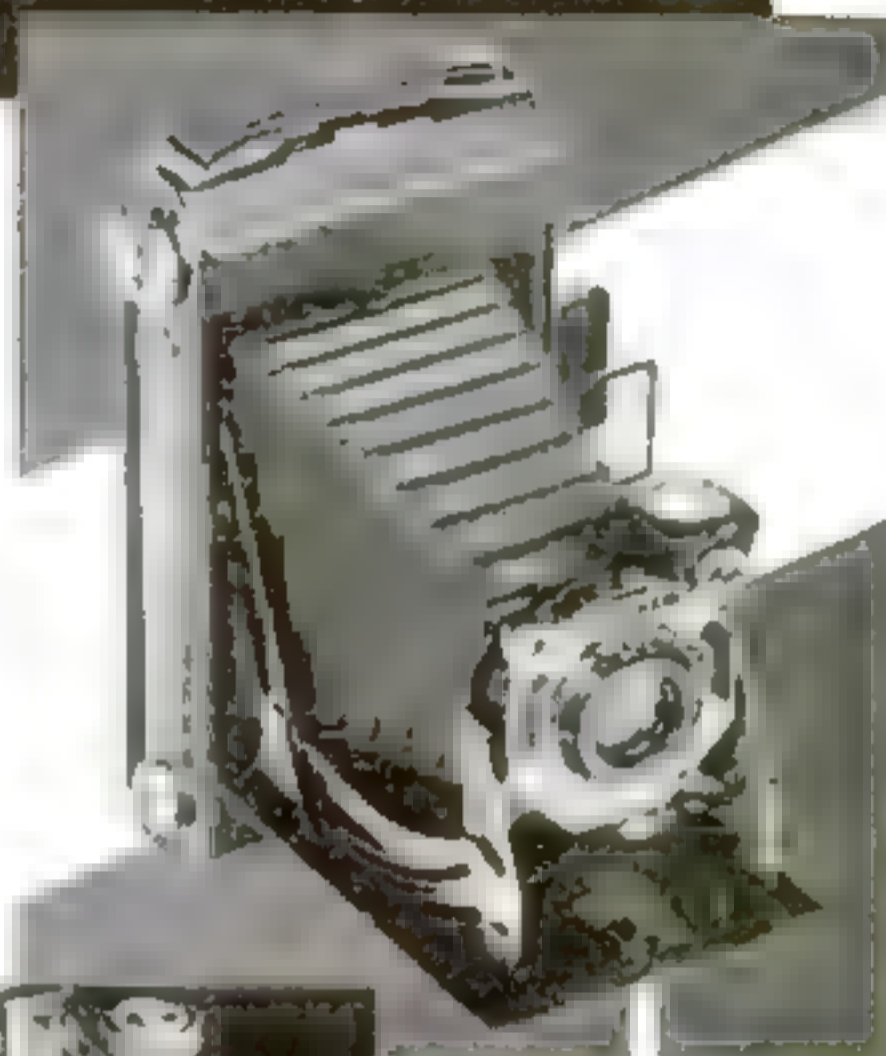
Richly appointed in metal and enamel, the Six-20 Kodak has style... sturdiness. For $2\frac{1}{4} \times 3\frac{1}{4}$ inch pictures, Kodak Six-20 with f.6.3 lens costs \$17.50. Kodak Six-16 with f.6.3 lens, for $2\frac{1}{2} \times 4\frac{1}{4}$ inch pictures, \$20. With the ultra-fast Kodak Anastigmat f.4.5 lens, Six-20 costs \$37.50; Six-16, \$40.

Snapshots at Night

The fast lenses on these Kodaks let you in on the latest indoor sport—snapshots at night. Two or three inexpensive Photoflood bulbs, a roll of Kodak "55" film—and you're ready to make snapshots indoors at NIGHT. For full details ask your Kodak dealer for the new folder, "Snapshots at Night."

Discover the Thrill of Home Enlarging...

You'll get big thrills from little negatives—at low cost—with the new Kodak Home Enlarger. Make startling size pictures of your family friends. It's easy with this splendid enlarger. The ground glass focusing panel assures sharp detail. Takes all negative sizes up to $3\frac{1}{2} \times 4\frac{1}{2}$ inches—enlarges up to 11×14 inches. Complete with lens—\$16.50.



PUPILLE—f.2

... aristocrat among miniature cameras. With an ultra-fast f.2 lens—Compug shutter, 1 to 1/500 second—eye-level finder—range finder and two filters. Takes 16 pictures on a roll of "vest pocket" film. In leather case, \$90.

VOLLENDIA—f.4.5

... an inexpensive miniature camera. Takes 16 pictures on a roll of "vest pocket" film. Three-speed Pronto shutter—f.4.5 lens—built-in self timer that lets you take pictures of yourself. Springs into picture-taking position with the touch of a button. Price, \$22.50; with f.3.5 lens, price \$33.50.



IF IT ISN'T AN EASTMAN, IT ISN'T A KODAK

FREE... more information

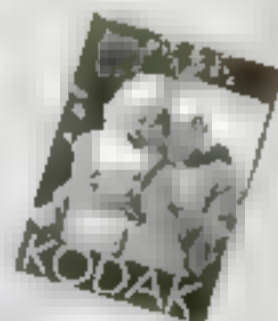
Mail this coupon today for your copy of the latest Kodak catalog. It gives you complete details about all the merchandise shown here and lots more that you'll want to own. Mail to Eastman Kodak Co., Rochester, N. Y.

Name _____

Street _____

City _____

State _____

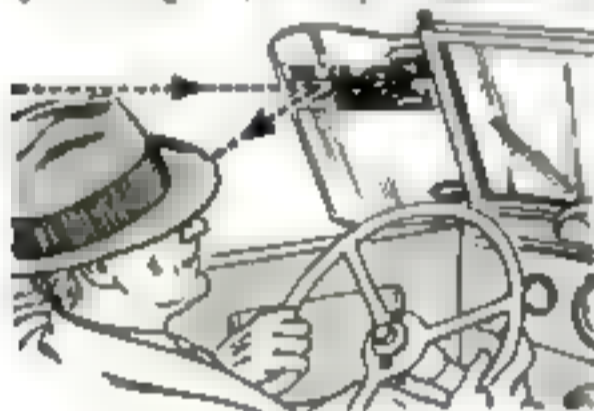


Handy Hints for MOTORISTS

Suggestions Valuable for All Car Drivers Contributed by Readers

Moving Stalled Car

IF YOU have ever tried to push a stalled car, you will agree that it can be quite a task, particularly if there is a slight grade upward. The next time you find yourself in such a predicament and no help is available, try your hand crank. Put the car in reverse or high gear, depending on the direction it is to be moved, and turn the crank with your right arm while you push or pull the radiator with your left. If the car is a heavy model, or mired in mud or snow, remove the spark plugs to ease up on the compression. Not long ago, a lone driver in New York State moved his stalled car free of a railroad crossing by resorting to this simple trick.—E. L.



Rear-View Mirror

DESIRING a rear-view mirror on the driver's side of my car without adding an extra piece of equipment, I conceived the idea of having a 4-in. wide strip on the left wind-wing silvered. I find that it does not interfere with the driver's forward view and can be adjusted to any angle. To protect it against rain and moisture, I applied several coats of thin waterproof varnish to the back side of the silvered area. The entire expense of silvering was no more than the cost of a mirror and the combination eliminates a bothersome accessory.—E. L. B.



Rolling Car Sideways

OFTEN when making home repairs in a crowded private garage it is impossible to maneuver the car into a good position that will be near the bench as well as a window. The writer got around this difficulty by using a simple roller-

skate arrangement. First, the rear end of the car was raised by placing a regular jack under the axle slightly at one side of the differential housing. A small block of hard wood, hollowed out to fit the bottom of the differential, then was fastened to the top of a sturdy roller skate with screws and nails. This assembly was placed on a large square of hardwood, fitted with stop blocks at each end, and eased under the differential as shown. Finally, the jack was removed. The car resting on the skate then could be shifted easily.—J. A.

skate arrangement. First, the rear end of the car was raised by placing a regular jack under the axle slightly at one side of the differential housing. A small block of hard wood, hollowed out to fit the bottom of the differential, then was fastened to the top of a sturdy roller skate with screws and nails. This assembly was placed on a large square of hardwood, fitted with stop blocks at each end, and eased under the differential as shown. Finally, the jack was removed. The car resting on the skate then could be shifted easily.—J. A.

Good Tire Spreader



THIS homemade spreader eliminates the usual difficulty of holding a tire open while inspecting it for puncture holes, tacks, or worn spots. It consists simply of a piece of $\frac{1}{4}$ -by 1-in. steel, heated and bent at a slight angle as shown. Two bolts are tapped into the short arm. In use, the spreader can be operated easily and rapidly with one hand leaving the other free. The bolts, held parallel to the tire, are inserted between the rim beads and then the handle of the spreader is pulled toward the user. This automatically spreads the edges of the tire apart. By working the handle back and forth as the tire is turned, a rapid inspection can be made.—W. E. S.

Repairing Timing Gears

WHEN my timing gears started to get noisy recently I was confronted with the problem of either paying a garageman \$10 for the job or trying to fix them myself. I decided on the latter and on removing the gears found that the fiber gear, although in perfect shape otherwise, was badly worn around the key slide. I remedied that, however, by filling the old groove with melted battery-top compound and by filing a new keyway on the opposite side of the gear.—J. H.

Distributor Cam Wrench

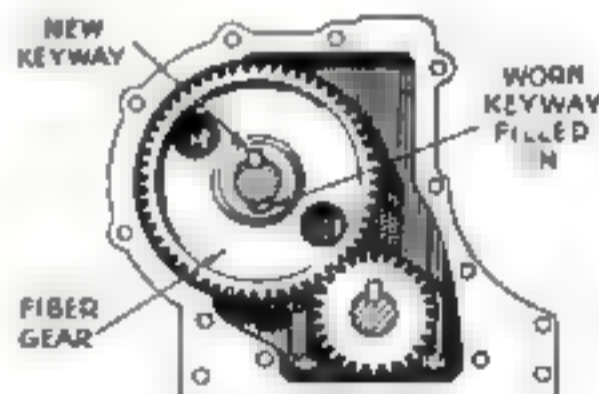
WHEN it is necessary to adjust a distributor, most home mechanics find it difficult to loosen the timing cam. Service men do the job easily with a special hook-shaped wrench, but few amateurs have such a tool. However, a twenty-penny spike can be made to serve as a good substitute. Merely slip one edge of the flat head under the cam and pull the spike end away from the shaft in a prying motion. The writer has used this makeshift successfully on several makes of motors.—L. Van T.



Twenty-penny spike, used as above, makes a good cam wrench.

Home Vulcanizing

ORDINARY cold tire patches can be made self-vulcanizing by applying, in sparing amounts, a solution of thirty grains of sulphur chloride dissolved in an ounce of carbon disulphide. After the mended tire has been driven for a short length of time, the patch will automatically become vulcanized.—G. S. G.



Home-repair job on your car's timing gears can be accomplished in the manner illustrated.

NEW TIRE SAVES LIVES

— Gives Months of Extra Miles

New Goodrich Silvertown Only Tire That Gives You Golden Ply Blow-Out Protection

HAVE you ever had a blow-out speeding along at 40, 50 or 60 miles an hour? Have you ever felt the steering wheel torn from your hands as if an invisible giant gripped it? Have you ever lived through those sickening seconds when your car lurches wildly from the road to crash in spite of all you can do?

An amazing invention

It's a risk no man should run. A risk no man has a right to expect his family to run. Especially since Goodrich engineers have now perfected the Life-Saver Golden Ply—the amazing new invention that makes the "safest tire ever built" 3 times safer from blow-outs at today's high speeds.

What causes blow-outs

Today, due to high-powered motors and smaller wheels, the heat generated *inside* the tire is terrific. Rubber and fabric begin to separate. A tiny *blister* forms. And grows—bigger—until **BANG!** A blow-out!

But now, to protect you and your family, every new Goodrich Silvertown has the amazing new Life-Saver Golden Ply. This invention resists heat. Rubber and fabric don't separate. Thus blisters don't form inside the tire. The great, unseen *cause* of blow-outs is eliminated *before* it begins.

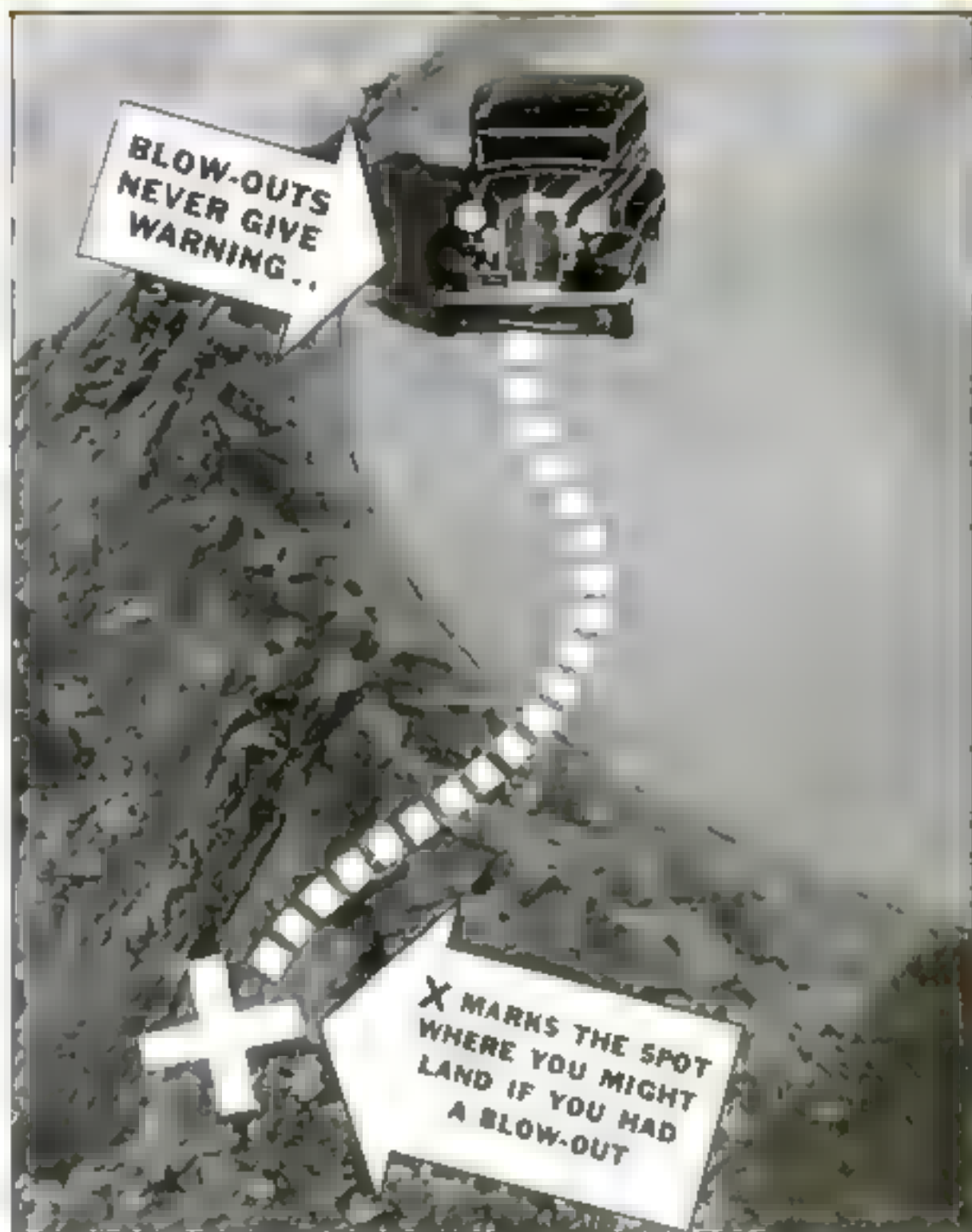
Here's proof!

Racing daredevils tested out the Golden Ply at breakneck speeds. Tested it on the world's fastest track. Not one blow-out. Similar tires *without* the Golden Ply failed at one-third the distance the Golden Ply Silvertowns were run.

Why take chances when you can be 3 times safer from blow-outs at high speeds—get months of extra mileage—at no extra cost! Goodrich Safety Silvertowns cost no more than other standard tires. Look for the dealer displaying the Goodrich sign or for your Goodrich dealer's name under "Tires" in your Classified Telephone Directory.



FREE! Handsome emblem with red crystal reflector to protect you if your tail light goes out. Go to your Goodrich dealer join Silvertown Safety League, and receive one FREE. Or send 10¢ (to cover packing and mailing) to Dept. 372 The B. F. Goodrich Rubber Co., Akron, O.



Heat starts "invisible blisters," which grow bigger and bigger until "BANG!"—a blow-out.



Life-Saver Golden Ply makes Silvertowns 3 times safer from blow-outs at high speeds.

The NEW Goodrich Safety Silvertown
Copyright, 1934, The B. F. Goodrich Rubber Co.
WITH LIFE-SAVER GOLDEN PLY

You never know when or where you may need SMOOTH-ON NO. 1

so keep a can in the home



ANY handy man can make hundreds of practical home and automobile repairs with Smooth-On No. 1 and avoid a repair bill every time. The above illustration is a typical example. A 50-lb. block of ice dropped on this icebox handle bent the cast brass lever stripped the screws out and splintered the wood. As larger screws could not be used and the lock could not be shifted, a new door seemed necessary. Instead the owner fitted the splinters back, filled the screw holes with about 5 cents worth of Smooth-On No. 1 and put back the screws. When the Smooth-On metalized, the lock became strong as new. The repair will last as long as the icebox.

SMOOTH-ON No. 1 stops leaks of water, steam, oil, gas and smoke. Makes a pressure-tight seal at joints, cracks and breaks in pipes, boilers, radiators, tanks, ovens, hot air and smoke ducts, gas, etc. Tightens loose handles on tools, cutlery, push brooms, umbrellas. Makes stripped nuts, bolts and screws hold. Tightens loose locks, hinges, casters, books, stems, chair arms and legs, posts set in masonry, concrete, etc. Stops leaks in automobile radiators, hose connections, cracked water jackets and gear cases, oil and engine, gas, kerosene, oil, lubricator connections, hub caps and wood screws from coming loose makes headlight and dash supports tight and proof against rust. Applied cold and boils in any metal, concrete, masonry, tile or wood.

Home and car owners find uses for Smooth-On every month in the year and save from 50 cents to many dollars on each application. Seek out these emergency and routine repairs yourself, avoid expense and delays, or professional fees and a busy day. You know instructions in the Smooth-On Repair Book which will be mailed on request. Be ready the instant trouble shows up by keeping a can of Smooth-On in your repair kit and the booklet handy for quick reference.

Get the booklet from us and Smooth-On No. 1 in 7-oz., 1-lb. or 5-lb. tins from any hardware store.

Smooth-On Mfg. Co.
Dept. 58 874 Communipaw Ave.
Jersey City, N. J.



Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58
874 Communipaw Ave., Jersey City, N. J.

Please send the free Smooth-On Repair Book.

Name _____

Address _____

7-34

Three Novelties

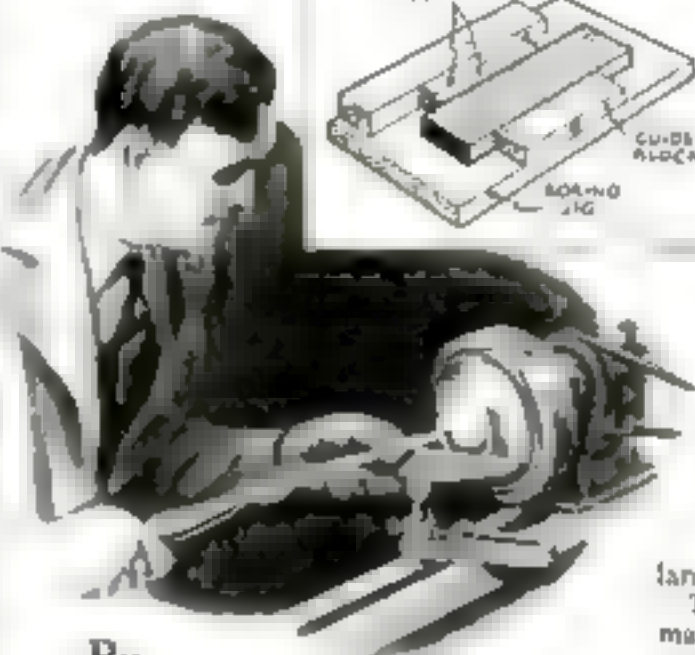
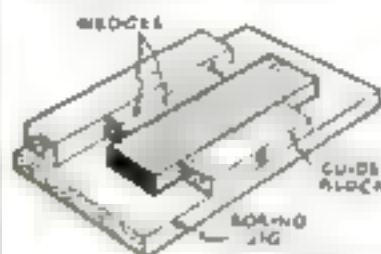
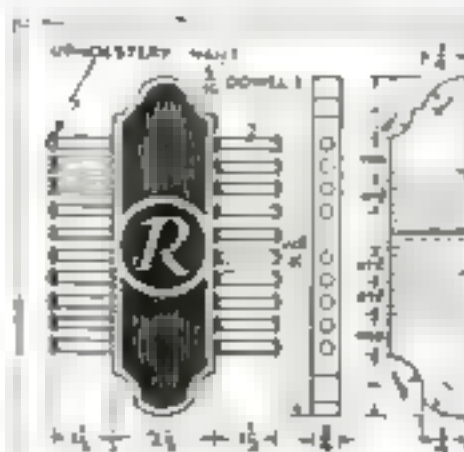
You Can Make Quickly

TIE HOLDER

EXTENSION BOOK RACK

TURNED BOX

This neat, space-saving tie rack consists of twenty short dowels glued into holes bored about $\frac{1}{2}$ in. deep in the centerpiece. To aid in boring the holes straight, a jig may be made as shown in the perspective sketch.



By
HERMAN HJORTH

DESIGNS for three simply made but decorative articles are given in the accompanying drawings: a tie rack, an extension book rack and an unusually ornamental turned box.

The construction of the tie rack is so simple as hardly to need any explanation. The materials needed are one piece of stock $\frac{1}{2}$ by $2\frac{1}{2}$ by $8\frac{1}{2}$ in. and 42 in. of $\frac{5}{16}$ -in. dowel rod. Plane the board first, bore the holes for the dowels (about $\frac{1}{2}$ in. deep) and then decorate the surface. As it is important to bore the holes straight, it is advisable to make a boring jig as shown. Make the guide piece

by squaring a line all around it and gaging in the center of both edges. If the spur of the bit does not emerge exactly where the lines cross, repeat the process until a true hole is produced.

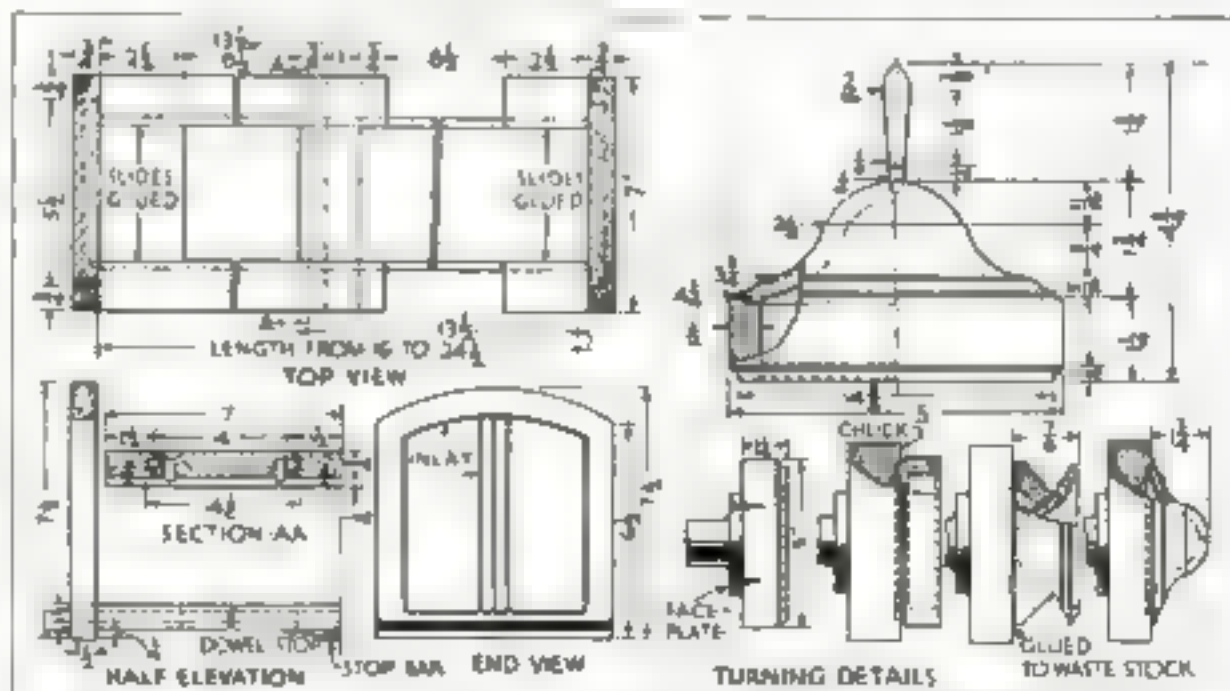
In the carving shown, the surfaces around the letter and between the borders are recessed. Greater contrast may be obtained by pricking the lowered surfaces with a wood carver's punch and staining them a darker color. The dowels are finally glued in place.

A fancy upholstering nail with a large head is driven into the end of each.

The extension book rack is useful for the man who needs a few books on his desk for ready reference. The materials required are 1 pc. $\frac{1}{2}$ by 4 by 17 in. and 2 pc. $\frac{1}{2}$ by 12 by 17 in. for the bottom, 1 pc. $\frac{1}{2}$ by 7 by 15 for the two ends, and 1 pc. $\frac{1}{2}$ by 1 by 7 in. for the stop bar.

Cut the bottom boards to the full length (in this case 17 in.), square them to dimensions, and saw the tongues and grooves on a circular saw. These may also be worked out on a shaper, or with a special plane, or even with a scratch stock (see P. S. M., Dec '33, p. 80). Clamp the three slides together and remove any unevenness with scraper and sandpaper. Now cut 3 in. off the end of each slide, square the ends, and glue the short pieces as shown in the plan view.

Get out the stock for the two ends in one board and square it to dimensions before cutting the ends to length. Lay out the dado



How the book rack and turned box are constructed. The ends of the rack can be ornamented with narrow lines of inlay, with a letter or other carved design, or with veneer.

joints $\frac{1}{2}$ in. from the plowed ends and chisel them carefully so as not to split the wood near the end. The ends may also be joined to the bottom with hinges, but the disadvantage of this method is that the screws in the hinges are likely to work loose in time and so cause some annoyance.

The ends may be cut to shape and decorated in various ways. The drawing shows narrow lines of inlay. A letter, as in the tire rack, or some other form of ornament may also be carved in the ends if you desire and will add to the appearance.

A THIRD suggestion for decorating the ends is by means of veneering. The simplest way to do this is to glue a piece of veneer to both sides of each end. Use casein glue and apply it to the wood only—not to the veneer. Keep the veneer from sliding out of place with a couple of fine brads, place a piece of newspaper over the veneers, and clamp each end between two boards. For further information about veneering see the author's book *How to Make Veneered Panels*.

The ends and bottom are now glued together, and the stop bar and dowels are screwed and glued in place. The book rack may be finished by the methods described in previous issues (see P. S. M., May, '34, p. 77).

The turned box illustrated is a good example of faceplate work, one of the most interesting wood-turning jobs. The materials required are 1 piece $1\frac{1}{4}$ by 5 by 5 in. for the lower part, 1 piece $1\frac{1}{4}$ by $4\frac{1}{4}$ by $4\frac{1}{4}$ in. for the lid, and 1 piece $7/16$ by $7/16$ by 2 in. for the knob.

The lower part of the box is cut from a plank and sawed approximately circular on a band saw. A faceplate is screwed to the center of the best side, and the block is faced off and turned to dimensions (see first detail drawing). Finish with sandpaper before removing it from the faceplate.

A SIMILAR disk a little larger in diameter is now turned from a soft wood such as white pine or whitewood. A recess is cut into which the bottom of the lower part is fitted. The fit should be so tight that the work must be forced into the recess (see second sketch). This process is called chucking. When the work runs true, it is hollowed out with a round-nose chisel, and, of course, the holes left by the screws disappear. After turning the recess for the lid to the upper edge, the part of the box is finished when well rubbed down with sandpaper.

Make a similar chuck for the lid. In this case it is impossible to fasten the stock for the lid to a faceplate because the screw holes would show on the finished work. It is therefore glued. Center the stock carefully on the chuck, spread glue on both parts, place a piece of paper between the glued surfaces and clamp them together with three or four hand screws.

When dry, the lid is hollowed out and partly turned as shown in the third sketch. The lid should fit snugly, but not too tightly into the recess cut for it in the lower part of the box. The lid is easily separated from the chuck by driving a chisel into the joint. The lid is now chucked as shown in the fourth sketch, and the turning of the outside completed.

The knob is turned between centers and glued into a hole bored in the lid with a small skew chisel.

The box may be given a French polish in the lathe. To do this, chuck the two parts as before and prepare a pad from a linen cloth wrapped around a ball of cotton waste. Put thin shellac and alcohol on the waste, fold the cloth over it and rub back and forth over the work as the lathe revolves at its slowest speed. Use a few drops of paraffin oil on the work to prevent the pad from sticking.



EDMUND LOWE, Famous Screen Star

I first met up with Union Leader on a smoking car. The traveler at my elbow loaned me my first pipeful.

"That's mighty fine Kentucky Burley," I remarked. "Smooth, well cured and mellow. What's the brand?"

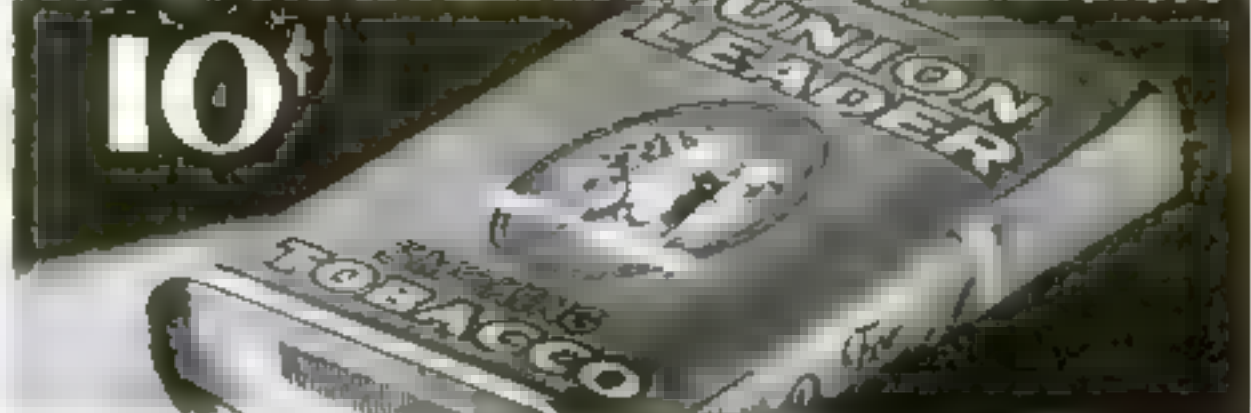
"Union Leader," he replied. "But I hope it won't prejudice

you when I tell you it costs only ten cents for a man's sized tin."

"Prejudice me? Say, I'll accept economy any time . . . when it buys tobacco like that!" (Fine for cigarettes, too.)

© P. Lorillard Co., Inc.

UNION LEADER
THE GREAT AMERICAN SMOKE



TO BUILD THINGS better



Ideal for sawing
No grain, No shipping.

REGARDLESS of what you build . . . from book-ends to automobile trailers . . . toys to chairs and tables . . . the workshop itself . . . you'll turn out a better job with this famous modern material.

Masonite PRESWOOD is easy to use. ALL-WOOD pressed into grainless, light, durable sheets, it can be cut into any shape. Will not warp, or crack. Moisture resistant. Once fitted, it stays fitted exactly according to specifications. Strong and sturdy with a surface as smooth as plate glass.

Homemasters everywhere are learning the downright joy of working with this tailor-made material. Try it yourself with the next thing you make. Send the coupon below for free booklet giving plans and specifications for a number of useful articles. You can get PRESWOOD in handy sizes, from leading lumber dealers everywhere.

MASONITE CORPORATION PS-7-34
111 W. Washington St., Chicago, Ill.
Please send me free booklet, "You Can Make These Useful Things." Also the address of the nearest lumber dealer who sells Masonite PRESWOOD.

Name _____
Street Address _____
City _____

Our BLUEPRINTS

Will Give You Expert Guidance

TO AID you in your home workshop, POPULAR SCIENCE MONTHLY offers blueprints with working drawings of a number of well-tested projects. The blueprints are 15 by 22 in. and are sold for 25 cents a single sheet (except in a few special cases). Order by number. The numbers are given in italic type and follow the titles. When two or more numbers follow one title it means that there are two or more blueprints in the complete set. If the letter "R" follows a number it indicates that the blueprint or set of blueprints is accompanied by photographically illustrated instructions which supplement the drawings. If you do not wish this supplement, omit the letter "R" from your order and deduct 25 cents from the price given. The instructions alone are sold for 25 cents each. Many other blueprints are available. Send a stamped and addressed envelope for a complete list.

FLYING AIRPLANE MODELS

Beech (Junkers, 1-ft.) 49-80	\$ 30
Neoprene X-11 29 in. 100-101	30
Seaplane Motor record 2 1/2 min. 102	25
S. E. 3a World War Plane 30 in. 100-101	50
Winnie Mae 4-ft. 141-142-143	75

BOATS

*Canoe 16 in. Canoe Covered Kayak with 64 ft. etc. 102-103-104 R	1 00
*Duck Boat Folding 270 R	50
*Outboard Racer 11 1/2 ft. 156-157-158-159 R	75
*Outboard Racer 10 ft. 4 in. 114-115-116-117 R	50
*Sailboat Motorboat, Combination (15 ft. 141 ft.) 137-138-139 R	1 00
Marron R. g. with J. h. for Above 123A	25
*13 ft. Rowboat Motorboat 147 R	50
*14 1/2 ft. Rowboat Motorboat 148 R	50
*16 ft. Rowboat Motorboat 149 R	50
Star D. va. Inst. at on when used with rowboat motorboat 150	25
*15 1/2 ft. Runabout or Sportboat (outboard or inboard motor) 173-174-175 R	1 00
Note: Full size patterns for all boats marked with an asterisk (*) will be drawn to order for \$1.50 per set. Simply add this amount to the cost of the blueprint. About one week is required to fill orders for patterns.	

FURNITURE

Bookshelf and Book Ends, Modernistic 100	25
Bookstand Modernistic 88	25
Chest, Treasure 78	25
End Table, Modernistic 88	25
Lamps, Modernistic 97	25
Mirror, School Frame 103	25
Par Cabinet and Corner Shelves 77	25
Sevens, Modernistic Folding 81	25
Sewing Cabinet Two 11	25
Shelves and Lamp, Modernistic 97	25
5 and, Low Modernistic 100	25
Table Tavern 105	25
Table, Tilt-Top, Oak top 20 by 24 in. 100	25

RADIO SETS

A. I. Wave Portable (battery) 217-R	30
Amateur Short Wave Receiver 155	25
Amateur Radio Transmitter 183-184	50
Amplifier Three-Stage Audio-Frequency 42	25

Five-Tube Short Wave (A.C. or D.C.) 225-R	25
Full Electric Headphone Set 130	25
One Tube battery operated 103	25
Screen Grid Set 109	25
Short-Wave Converter Unit 137	25

SHIP AND COACH MODELS

{Construction kits are available for some of these models. See page 98}

Bark Scenic, Half Model 135 (in 1) 108	25
Battleship—U. S. S. Texas (3-ft. hull) 107-108-109-100	1 00
Boat's Clipper Ship 121-122	50
Clipper Ship (hull) 32	25
Clipper Ship 20 in. hull 57-58-59 R	1 00
Clipper Ship (hull) 9 1/2 in. hull 119	25
Constitution (21 in. hull) 57-58-59 R	1 00
Cruiser Indianapolis 7 in. long 214	25
Destroyer—U. S. S. Preston 1 1/2 in. hull 125-126-127 R	1 00
Galleon Revenge (25 in.) 206-207-208-209	1 00
Galleon, Spanish Treasure 24 in. 46-47	50
Hartford, Farragut's Flagship 33 1/2 in. hull special prints 22-222	1 25
Mayflower 7 1/2 in. hull 83-84-85 R	1 00
Miniature Coach and Covered Wagon for Decorating Boxes etc. 202 R	50
Motorboat 20 in. Cruiser 83-84 R	75
Motorboat Working Model 20 in. 196	25
Lincoln, Manhattan 12 in. long 204	25
Plate Gallery or Potluck (20 in.) 44-45 R	75
Roman Gallery (19 in.) 138-139 R	75
Sails—Square and Fore-and-Aft for Whaler Wanderer or any Model 185-186	50
Santa Maria 18 in. hull 76-75-78 R	1 00
Schooner—Bluebonnet (21 1/2 in.) 110-111-112 R	1 00
Stagecoach (Cody with horses coach body 13 in. long 146-147-148 R	1 00
Steamboat Mississippi (19 in.) 84-85-86 R	1 00
Viking Ship (20 in.) 41-42 R	75
Weather Vane Ship Model (30 in.) 86	25
Whaler—Wanderer 20 in. 83 to 156	1 00
Yacht Sea Scout (12 in. sailing 106-107 R	75
Yacht (20-in. racing), 48 R	50

MISCELLANEOUS

Doll's House, Colonial 72	25
Log Cabin (three rooms) 134 R	50
Microscope Kit, Portable 220	25
Perpetual Star Chart 216	25
Toy Birds and Animals 116 Sawed 58	25
Toy Drill Press, Lathes, Saw etc. 115	25
Toy Dump Truck Fire Engine, etc. 101	25

Popular Science Monthly 381 Fourth Avenue, New York

Send me the blueprint, or blueprints numbered as follows:

No. _____ No. _____ No. _____ No. _____

Patterns for

Reprints alone for _____

I am enclosing _____ dollars _____ cents

Name _____

Street _____

City and State _____

Please print your name and address clearly

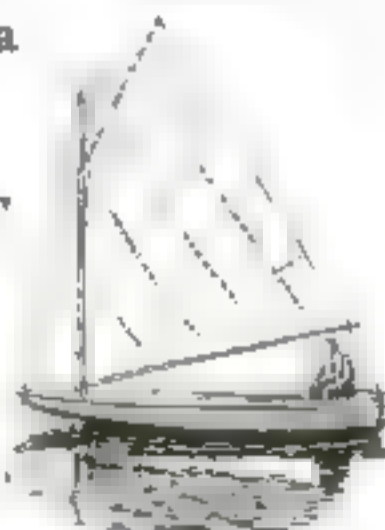
For All-around Sport Build a



Designed for
Popular Science
Monthly
by
William Jackson,
Naval Architect

SAILBOAT- MOTORBOAT

YOU cannot build a better boat for all-around sport than our combination sailboat motorboat *Dawnless*. She is 15 ft. long and fast under either sail or motor. Unlike many sailboats, especially homemade ones, she draws very little water and is not heavy. And when propelled by an outboard motor she does not squat and drag. Blueprints and instructions, \$1 with full size patterns, \$2.50. Order Blueprints Nos. 121-122-123-R.



WE OFFER MEDALS TO GUILD CRAFTSMEN

(Continued from page 74)

but leave the date to be fixed later. If your club has fewer than twenty members, start a membership drive at once. Appoint a committee to obtain the names and addresses of prospective members from hardware, paint, and lumber dealers, and all other sources of information. Visit these men, outline the purposes of your club, and urge them to join. Get your local papers to publish articles about your club, and each time a meeting is announced, include an invitation for all craftworkers to attend.

ADVISORY COUNCIL.

Professor Collins P. Bliss
Dean of the College of Engineering
New York University

Professor Clyde A. Bowman
Dean of the School of Industrial
Education, Stout Institute
Menomonee, Wis.

Harvey Wiley Corbett
Architect, New York City

Dr. Hugh S. Cumming
Surgeon-General, United States
Public Health Service

Maj.-Gen. Benj. D. Foulou
Chief of the Air Corp. U. S. Army

Capt. E. Armistead McCann
Founder Ship Model Maker's Club

Dr. Francis G. Pease
Astronomer, Mt. Wilson Observatory

Frank A. Vanderlip
Banker and Publisher, New York

First among the clubs to make plans for acquiring land and constructing a clubhouse is the Tucson Homeworkshop Guild, of Tucson, Ariz. A building 30 by 40 ft. will be erected to house the meeting room and a workshop. One of the members has donated a plot of land 50 by 120 ft. for the site. The titles to land, building, and machinery will be held by the trustees of the club.

The organization of a junior auxiliary for boys has been undertaken by the Topeka Homeworkshop Club, of Topeka, Kans., in cooperation with the Y. M. C. A. The club will provide instructors, and the meetings will be held in the Y. M. C. A. building in a room set aside for the use of the boys, who will be allowed to choose their own officers and select their own projects. The Topeka club is leading the way in this work with boys in the hope that it may result in a nation-wide organization of junior homeworkshop clubs affiliated with the Guild.

The first exhibition of the Topeka club is scheduled to be held in the Central Market. V. D. Robb is chairman of the exhibit committee.

The taking of photomicrographs was demonstrated at a recent meeting of the club by C. W. Shadwick, Jr., a laboratory technician. Steve Smith, one of the club members, explained and demonstrated the developing processes and made prints from various negatives brought to the meeting by club members. Smith had previously given a demonstration on ordinary photography and the use of photoflood lamps for indoor work. Other demonstrations given recently were on show-card writing by George Gladfelter, a professional window trimmer, and on hardwood finishing by C. M. Fountain, an experienced piano finisher.

The club library (Continued on page 80)

IT'S HARD TO BELIEVE THEY ONCE CALLED ME 'SKINNY'



Special QUICK WAY TO PUT POUNDS ON FAST!

Astonishing gains with new double tonic. Richest imported brewers' ale yeast now concentrated 7 times and combined with iron. Gives 5 to 15 lbs. in a few weeks

NOW there's no need to have people calling you "skinny", and losing all your chances of making and keeping friends. Here's a new, easy treatment that is giving thousands healthy flesh and the girls attractive curves—in just a few weeks.

As you know, doctors for years have prescribed yeast to build up health for rundown people. But now with this new discovery you can get far greater tonic results than with ordinary yeast—retain health, and in addition put on pounds of solid flesh—and in a far shorter time.

Not only are thousands quickly gaining good-looking pounds, but also clear, radiant skin, freedom from indigestion and constipation, new pep and energy.

Concentrated 7 times

This amazing new product, Ironized Yeast, is made from specially cultured *brewers' ale yeast* imported from Europe—the richest yeast known—which by a new process is concentrated 7 times—made 7 times more potent.

But that is not all! This marvelous, health-building yeast is then ironized with 3 kinds of

strengthening iron. Day after day, as you take Ironized Yeast, watch flat chest develop and skinny limbs round out attractively. And with this comes clear skin, new health—you're an entirely new person.

Skinny is a serious danger

Authorities warn that skinny, anemic, nervous people are far more liable to serious infections and fatal wasting diseases. So build up quick, before it is too late.

Results guaranteed

No matter how skinny and weak you may be, this marvelous new Ironized Yeast should build you up in a few short weeks as it has thousands. If you are not delighted with the results of the very first package, your money instantly refunded.

Only be sure you get *genuine* Ironized Yeast, not some inferior imitation. Look for "IY" stamped on each tablet.

Special FREE offer!

To start you building up your health right away, we make this absolutely FREE offer. Purchase a package of Ironized Yeast at once, cut out the seal on the box and mail it to us with a clipping of this paragraph. We will send you a fascinating new book on health, "New Facts About Your Body", by a well-known authority. Remember, results are guaranteed with the very first package—or money refunded. At all druggists. Ironized Yeast Co., Dept. 437, Atlanta, Ga.

On the ATLAS
9' Screw Cutting Lathe

[illegible]

ATLAS PRESS COMPANY
1855 N. Fletcher St.
Hastings-on-Hudson, N. Y. 10743

• SHOW CARD LETTERING

[illegible]

4 d d r : 3 4

HAND-EE GRINDER

[illegible]

WHEEL & HPG CO.

IN SHAPES AVAILABLE

LARGER SIZES

CHICAGO WHEEL & HPG CO.

Sole Chicago Branch

BUILD YOUR OWN RADIO

FREE CATALOG

Send for **ALLIED'S**
Big New 1934 Catalog
Featuring his
aircraft, new three-
tube Super Wave King
Radio and more to make
Radio Real for the
price you can't
believe. Write today
for this valuable book
at a FREE Dept.
\$2.00 - Each copy mailed



Allied Radio

CORPORATION

835 W. JACKSON BLVD., CHICAGO, ILL.

The trapdoor is of 22-gage sheet brass. The cigarette rest and the spring are riveted in as shown. The knob of the catch is made from a copper rivet. This must be given a square shoulder to guide the slide. Make the slide, assemble the catch, then solder on the hinge. Finish the piece with clear brushing lacquer. — DOUG HOLMSTROM



SMALL STEP LADDER WILL NOT SLIP



For the 100-ft-long, 100-ft-wide, 10-ft-deep wall, the ladder from slapping

Y^{ou} can use the ladder on polished floors without fear of slipping or marring either the floors or the furniture. It may be hung up in the closet to be instantly available. The ladder is made of 1 by 4 in. stock. The rungs are 2 ft. 6 in. long. Each end of these is cut 1 in. wide being 30 deg. and the rungs are 18 in. long and are placed 8 in. apart. The ends are fastened with 1 1/2 in. No. 9 wood screws. The sponge rubber strips are 3 in. x 1 in. and are applied to blocks of 1/2 in. thick wood which are screwed to the sidepieces of the ladder as indicated in the second photograph. The pads are fastened to these with a liberal cement. The sponge rubber or the ladder illustrated was obtained by cutting up an inexpensive kneeling pad.—D. R.

FILLING EDGE OF FILE TO MAKE IT "SAFE"

THERE are times when using a file that one does not wish to have the edge of the file cut, scratch, or mar the work. Safe-edge files are made especially for this purpose, but the home worker is not likely to have them in his tool kit, and it is costly to grind the edge of a regular file smooth for a single job. There is, however, a simple solution. Smear enough plastic wood composition or similar material into the edge to prevent the teeth from functioning. Upon drying, sand this safe edge smooth. After you have finished with the file, lacquer solvent will soften the filling material, which may be cleaned out.





MECHANICAL WONDERLAND

*At The
Century Of Progress.*

*See The Amazing Display
Of Over 200 Working
Models—All In Motion.*

POPULAR SCIENCE MONTHLY cordially invites you to visit a most fascinating demonstration of mechanical principles graphically shown by more than 200 working models.

This striking and unusual display—in General Exhibit Building One at the fair—demonstrates for old and young the basic mechanical principles upon which the operation of the intricate and marvelous machinery of the present day is based.

Thousands upon thousands of people visited this most unusual Exhibit last year. So great was the attendance and so enthusiastic were

the comments of the visitors that Popular Science Monthly decided to again exhibit "Mechanical Wonderland" at the Fair during 1934.

The Exhibit is being presented by Popular Science Monthly through the courtesy of the Newark (N. J.) Museum.

Attendants are on hand to answer questions and explain the principles of the operating models.

Be sure to see "Mechanical Wonderland," General Exhibit Building One—Group P, Section 2 and 3.

VISIT POPULAR SCIENCE MONTHLY AT THE WORLD'S FAIR

PAGE after page of latest features in this interesting catalog — Hauled Power, a twin hatless like a four, dash start primer, painted Co-Nine that steers when you let go, quiet spiral gear drive, certified horsepower. Nine outstanding service models in the any craft.



cause to crumple. There
racers, one with mile-
a-minute speed. Time
payments with prices as
low as \$79.10. We're
today's OUTBOARD
MOTORS CORPORATION
ATTENTION 5193 N. 27th
St., Milwaukee, Wis.

EVINRUDE *Estco'*

This new 9" x 4" sewing by 31 bed "WIREBOND" LATH is a
Bridgman's new sewing metal by taking Lath: takes 11" be-
ween strips. Call also for used & new things to be re-
dies etc. Many more: www.bridgman.com www.bridgman.com
pours out 31" ball or 11" ball. www.bridgman.com
from which makes for 2 cents per hour. 2 x 2
dies 11/16" & 1/2" for 1/2". True with
reversing, square, pressing switch and belt-
ing. \$21. 1/2" for descriptive
Circular No. 31-11. www.bridgman.com

75

Abstract

2007
 Terms
 1200 per
 month



SOUTH BEND LATHE WORKS 
#10 E. Madison St., South Bend, Ind.

LEARN AT HOME

to play by your own
 rules. (While I see
 the p. in your country
 your Association is
 playing a role and
 it is a role that
 makes you a man
 simple and a
 the of the
 and only one
 that is the

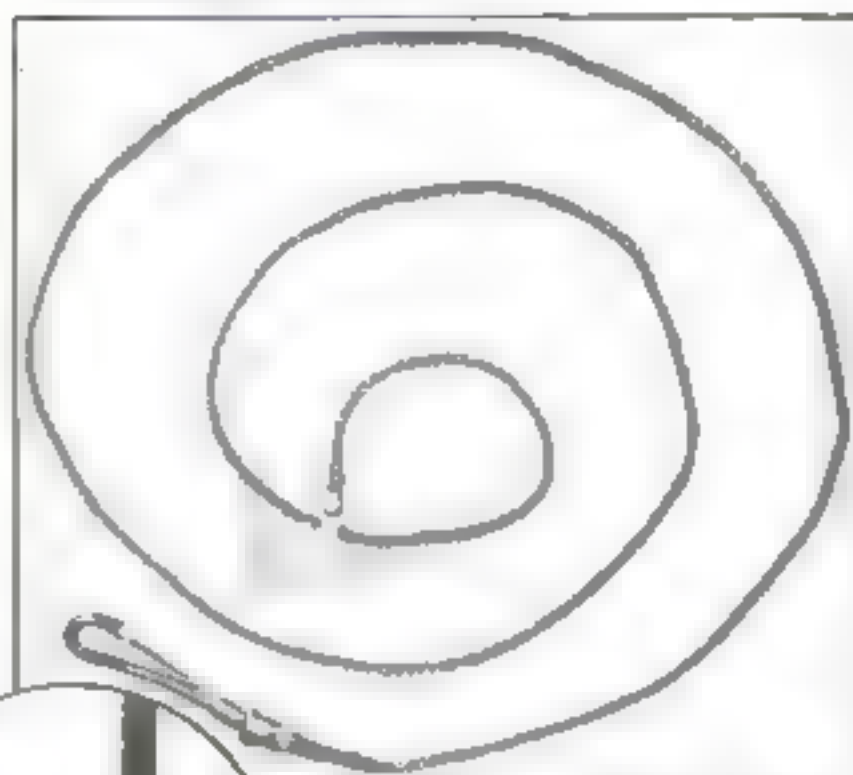
FREE BOOK While today, it has been found that as few as three applications for an organ can result in a waiting list of several years! To avoid going through this, get your organ now and enjoy it while you wait.

U.S. School of Music, 17 Broadway, New York, N.Y.

[illegible]

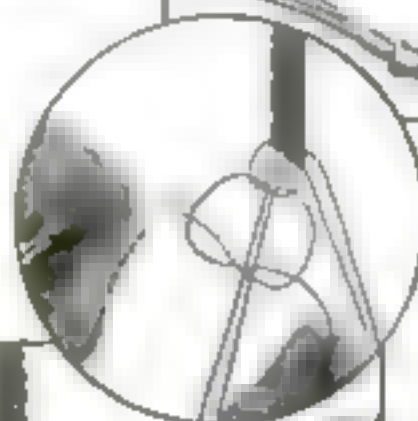
(Continued from page 76)

serviceable watch guard on page 76 combines the narrow and wide styles of strip. You will need two lengths of cord 60 in. long and one 40 in. Double them in the middle and knot sufficient of the wide strip with the six cords to form a bell loop, tie these off securely and cut away the excess of the two shorter cords. The remaining four are used for the narrow strip to a length of about 6 in. Then divide them two parts and



A strong yet light dog leash made with the narrow style of knu ting shown on page 76

Right Using one set of four cords to tie a square knot *Below* The next knot is tied with four cords at the right side



with each the simple square knots without any filler cord. The ends are passed through the watch ring, brought back to the main narrow strip, and tied firmly. If you wish something exceptionally fine for a watch guard, use a good grade of silk fishing line instead of the heavier cord.

The hat cord shown on page 76 is simply a length of the wide strip knotted with six cords and lapped over at the ends. Two strips of the narrow style may also be used or one long strip of the narrow may be placed around the crown of the hat twice.

This is the thirteenth in a series of articles on knot work. For other designs and methods see P. S. M., Nov. '32, p. 77, Mar. '33, p. 68, April p. 75, May p. 63, June p. 82, July p. 65, Sept. p. 65, Oct. p. 67, Dec. p. 73, Jan. '34, p. 63 (reelined huckles for knot-work belts), Feb. p. 61, and Mar. p. 103.

A window shade mounted to keep dust away from the books and magazines held in a slot

MANY house tinkers keep their workshop library in open bookshelves right in the workroom. This is where it should be, but the library is soon a sorry-looking mess unless the books and magazines are dusted pretty often. To overcome this difficulty in my own shop, I nailed a strip of board about 1½ in. wide to the top shelf of the case and painted it to match the rest of the bookcase. Then I fastened an ordinary window shade complete with roller, behind the strip. When the library is not in use or dust is flying about, the shade is pulled down in front of the shelves.—JOSEPH GRANT

Stirring rods for mixing chemicals in the home laboratory can be made from ordinary glass towel rods bought in a ten-cent store. These have flattened ends that make it easy to crush chemicals in the bottom of a graduate. Make a deep file mark in the middle of one of the towel rods, break it in half lengthwise, and you have two excellent stirring rods.—G. S. G.

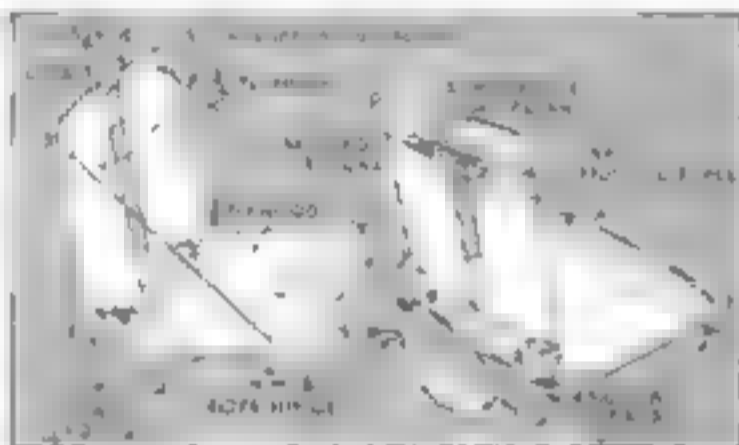
CANOE SEAT MAKES PADDLING EASIER



This seat was designed to fit a canvas-coveed kayak but it can be modified to suit canoes of the more conventional types.

THIS folding seat was designed for use with the PORTLAND SCIENCE MONTHLY canvas-covered kayak because the backward pitch of the seat affords a more restful position than sitting flat on the floor. The clothesline cords at the side, which fit the body tightly, give support to the paddler and enable a more powerful stroke to be used. If such a seat is made for general use, not in a kayak, it should be wider and, of course, the front and back edges should be straight rather than V-shaped.

The back strips are 1 in. plywood left over material from the floor boards of my kayak. The seat is 1/4 in. plywood remaining from the kayak frames. The cord used is 1/4 in. clothesline, let sufficiently long to tie a sheepshank knot in the back so the angle of the seat can be adjusted. A study of the drawings will show the general method of construction, and the builder can work out the details to suit himself. For added comfort I laced two pieces rubber pads in the seat and one on each back piece. —EUGENE H. TAYLOR



HOW TO USE WIRE-DRAWING PLATES

FEW mechanics, amateur or otherwise, know much about wire-drawing plates, yet these tools are most useful, and once tried, are hard to get along without. They are particularly useful to model makers and in the long run save considerable time and money.

The plates are made in several styles. With them wires of copper and similar soft metals, and even mild steel, can be made round, square, knifed-edged or half-round. With two plates in the round variety, it is easy to reduce 1/8 in. wire to 1/64 in. with almost no loss of material and an increase of length of almost 6400 percent. The plates are obtainable at jewelers' supply houses and cost only about \$1.50 each.

The operation is this: Clamp a plate upright in a vise, name-face to the front. Sharpen one end of the wire to be drawn, making a

long point. Insert the point in a hole small enough to snugly grasp it with pliers, and pull it through using a smooth, steady force. Repeat with the next smaller hole, and so on. After being reduced in several holes, the wire will need to be annealed by heating it to red heat.

The drawing it will be noticed, not only reduces the diameter, but straightens the wire so that there are no local kinks whatever. This, in itself, is an advantage in most kinds of work. Besides, the exact degree of hardness and stiffness can be obtained to suit the requirements of the work in hand. The principal advantage, however, is that the owner of such plates needn't stock but one or two sizes of the metals he commonly uses as he can quickly make any smaller size necessary.

The usefulness of the plates does not end with shaping strong hardening and strengthening wire. They can be used for making tubing. Simply cut a strip of sheet metal of a width approximately 1 1/2 times the outside diameter of the tube required, shape a taper at one end, bend lengthwise into a shallow trough, and draw like wire until the joint is closed. If desired, the joint can be hard-soldered or soft-soldered. —EDWIN M. LOVE

If there is no better work shop club in your home community, send in the coupon appearing on page 91.



The wire is reduced in size by drawing it through successively smaller holes in the plate, which is clamped upright in a vise.

"I PREFER THE
MOSQUITOES,
DEAR!"



HE lit that pipe to drive away the gnats. But the sweet young thing wisely decided she'd rather be somewhat bitten than completely asphyxiated. Even a Roman's nose would wrinkle at the fumes of rank tobacco issuing from that long neglected smokestack.

Clean it out, Romeo; put Sir Walter Raleigh Smoking tobacco in the bowl—and slip your arm around those dim shoulders. You'll fill the air with a June-like aroma that positively encourages romance. Sir Walter is a gentlemanly mixture of Kentucky Burleys selected for their mildness, blended for their fragrance. Kept fresh in gold foil, it has captured the fancy of smokers young and old. It will win you, too!

Brown & Williamson Tobacco Corporation
Louisville, Kentucky Dept. 317



Send for this
FREE
BOOKLET

It's 15¢—AND IT'S Milder

FREE!
"Revealing
Nature's
Wonders"

WOLLANSACK OPTICAL CO.
575 Hudson Ave., Rochester, N. Y.

Wollensak TELESCOPES
MICROSCOPES
BINOCULARS

EVERYTHING for the POPULAR SCIENTIST

LABORATORY APPARATUS

Slide Making Set

AMERICAN MACHINE & TOOL CO.

MICROSCOPY

SLIDE MAKING SET

AMERICAN MACHINE & TOOL CO.

1/2" DRILL PRESS \$6.95

AMERICAN MACHINE & TOOL CO.

25¢ REAL SPEEDY STEAMBOAT 90¢

NEW THRILLING EDUCATIONAL

WORLD WIDE ALL WAVE RADIO \$1.95

ACE RADIO LABORATORIES

MICROSCOPE SHOWS INSECTS WERE WORLD'S FIRST INVENTORS

(Continued from page 30)

amples of instrument making of the highest order. The horsefly, that summer pest that can be identified by its metallic appearance has a set of skin-piercing and cutting instruments of amazing perfection. Some of the cutting blades, for instance, are set with teeth so delicate that more than a hundred of them can be placed in a space less than one thousandth of an inch long!

THE very lenses through which you gaze at these microscopic wonders are not new! Although opticians learned only yesterday, as time goes, how to make fairly good lenses, the insects perfected the art millions of years ago. In the compound eye of a house fly or other insect are scores of tiny lenses, each capable of forming a perfect image like a microscope camera. In fact, skillful microscopists actually have photographed objects through such lenses.

You probably recall the row of hooks in the refrigerator of a butcher shop on which were hung hams and sides of beef. The honeybee, long before butcher shops were known, invented these hooks. If you doubt this, get the wings of a bee and place a pair of them on a slide. You will find liquid petrolatum excellent for temporary mounting of the wings, although water or air can be used. Look at the forward edge of the hind wing and you will find a row of marvelously formed hooks, protected by a turned-over portion of the wing covering. Now inspect the rear edge of the front wing. You find that it likewise is curled over, to form a groove in which the hooks engage, thus locking the two wing sections together while the bee is in flight. When the bee folds its wings, the hooks disengage automatically.

While you are studying the honeybee, examine its legs. You find here an amazing collection of specialized tools. At the outer joint of the front leg there is a semicircular, tooth-lined notch over which a hinged plate fits. The bee uses this to clean her antennae. A row of stiff hairs along the outer segment, opposite the notch, enables the bee to comb pollen grains out of her eyes. The second middle leg is equipped with a stiff spur that is useful when the bee has to remove pollen grains from the pollen basket of the third and largest leg. This third leg also is equipped with ingenious pincers, fitted with a great row of teeth, with which the bee removes plates of beeswax from her body. Can you find a more marvelous collection of tools elsewhere?

Long before the automobile horn was invented, the cicada, or seventeen-year locust, was sending out signals that could be heard a mile away. In doing this, the insect employed a sound-producing system that the microscope has revealed to be marvelously designed. The outside equipment of the cicada's sound apparatus consists of two membranous plates visible as smooth areas on the under side of the body. These are vibrated by the complex mechanism within to produce noise.

HYPODERMIC needles are true antiques, in the insect world. The spider uses a pair of sharp-pointed claws at the front end of its head, to inject poison into flies and other victims. The centipede that you see scurrying about in the summer has a similar pair of poison claws that it uses to kill worms, insects, and other food. Digger wasps, found in the West, could have taught man, thousands of years ago, how to use anesthetics. With its sting, which the microscope reveals in all its perfection, this wasp puts to sleep certain caterpillars that it stores in burrows in the ground along with its eggs. The cater-

pular slumbers while the eggs hatch. The larvae, upon emerging, find a supply of fresh meat on hand.

The ants are among the most remarkable insects. They have a complex social life and employ tools and methods that suggest the influence of intelligent invention. You will find it worth while to visit the home of the leaf-cutter ant. Explore the nest until you discover little balls covered with a whitish growth. Examine these balls with your microscope. You find that they are composed of leaf fragments but the ants have cut and packed together. The white growth is revealed to be a fungus, which the ants have been cultivating for food.

THERE is almost no end to the list of mechanical devices that your microscope will reveal in the land of insects and other small creatures. Insect legs, antennae, mouth parts, wings and almost every other part will prove interesting, and can be compared with some man-made mechanical device or instrument. Even the workshop sanding belt finds its counterpart in the delicate tongue of a pond snail. You can separate the tongue from the rest of the snail by dropping the body, without the shell, into a little hot lye solution. The tongue, which does not dissolve, usually can be seen with the naked eye, in good light, as a whitish speck.

One of the most remarkable things that the microscope reveals about insects is that their outside skeletons are made of a very remarkable material, the amber-colored chitin with which you are, by this time, familiar. Pure chitin is white. When you consider that it is used for making all kinds of insect equipment, from keen-edged saws and lances to air-tube reinforcing spirals; and that cutting instruments made from it apparently never require sharpening, you will agree that the insect has excellent raw material for its inventions. Relatively little is known about the chemical composition of chitin.

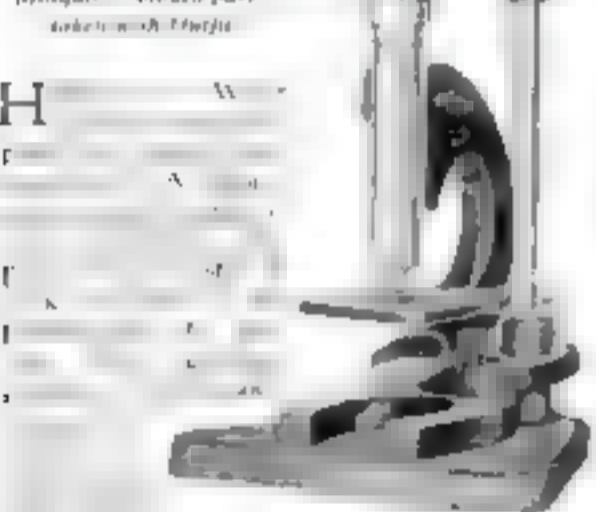
Microscopic study of insects can have a value more practical than the mere satisfaction of curiosity. Suppose, for instance, that you have a prize shrub that has fallen victim of an unfamiliar insect. With your microscope you can examine the insect's mouth parts and determine whether they are designed for sucking juices or eating solid food. If the bug is a juice sipper, you will have to use a spray that will plug up its breathing pores or a phyticide that with a gas. If it eats solid food, you can spray arsenate of lead or other suitable poison on the plant instead of the insect.

For delicate surgical work on insects and the like you will find it convenient to grind a dissecting needle until it has a knifelike edge extending back a short distance from its point. You will find a fine-grained oilstone suitable for working the needle into shape.

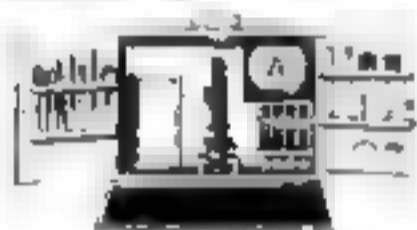
THE conventional form of microscope slide box sometimes proves to be inconvenient or otherwise objectionable. Mounted objects such as bee stings, when free to move about in the bottom of a slide cell, will settle at one margin of the cell if the slide is kept on edge for a few days. Also, when slides are filed in this position, the specimens are difficult to examine and the labels hard to read.

Many microscope workers have found it more satisfactory to use trays that hold the slides in a flat position. Several types of such holders have been developed. The slide box illustrated is an attempt to provide a compact and convenient file, and one whose construction is not particularly difficult. The materials needed include a quantity of 3/4" by 1/2" wood strips, (Continued on page 97)

Alderson engine, main.



በየቀኑም ጥናታዊ ምርመራ
ደብዳቤ ላይ ይጻፍበታል።

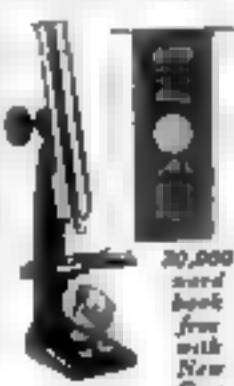
[illegible]

New!
49-Piece
Gem
Science
Kit
\$9.50

[illegible]

Now \$14.50—New Gem Microscope

Famous for showing as much more depth and detail than all the features but emphasizing the basic necessary rock and mineral including variable magnification of 10 to 400 times and 100 to 400 diameters. Now \$5 + 10, including case 1 year money back. Microscope Experiments. Extra objective lens for use 100 to 300 diameters. \$2.95 including 20,000 word Book No. 2. At dealers or direct if no dealer in your area. (Money-back guarantee)



BAUSCH & LOMB OPTICAL CO

USE COUPON ACROSS PAGE

$$L = 4 \text{ mm} \quad f_s = 10^5 \text{ Hz} \quad P_{\text{max}} = 5 \text{ W}$$

walnut being the material used in the box illustrated a quantity of cardboard, some glue, small nails, sheet copper or other non-rusting metal, a strip of soft leather such as calf skin, and two snap clothes fasteners.

The trays hold the slides in a row, each one being separated from its neighbors by slimmer strips of wood or plastic. Flat blocks can be used as separators. Each slide is supported at two points by the parallel strips of cardboard running along the tray bottom. To remove a slide simply press down one end; the other end rises so that you can grasp it.

A STUDY of the photographs will reveal the method of arranging the sheet metal arms that connect the trays together. The holes in all arms should be exactly the same distance apart. By individually hanging each tray that is, by using only two-holed arms, is possible to uncover any tray without disturbing the others, or to unfold all of them at once. You can use as many trays as you desire and make them any convenient length. The top tray is covered by a thin wood lid attached with leather hinges. The whole assembly is held in a closed position by a leather strap that passes ~~from~~ the front edge of the bottom tray over the top to the rear edge of the same tray. The strap is separated in the middle and provided with a pair of snap-buckle fasteners as shown. Although leather generally has a slight elasticity that makes this arrangement practical you may find elastic ribbon to be better.

Trays can be labeled along their front edges and each slide and compartment numbered so that slides will occupy assigned places.

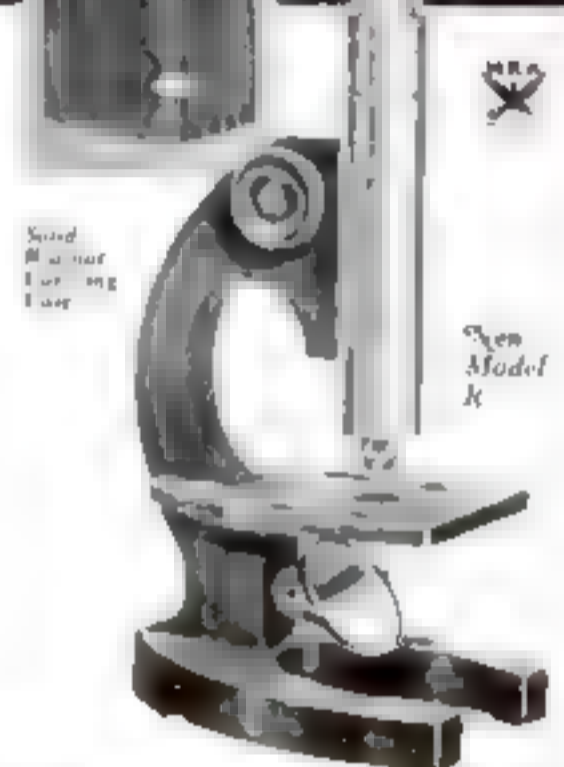
If in building the tray, you happen to cut your finger take advantage of the opportunity and secure a specimen of blood for examination with your microscope. Place a drop of blood on a clean slide and spread it out with a clean, square cover glass or the end of another slide until it forms a thin layer. Flood the smear with a drop or two of alcohol, drain off the excess and touch a match to the remaining alcohol allowing it to burn off. This fixes the blood smear. You can apply stain to the blood if desired, rinsing it off and allowing the specimen to dry before mounting permanently in balsam. Under the microscope, the blood smear resolves itself into a surprising number of particles, most of which are red blood corpuscles.

FLYER HAS FLOWN EACH DAY FOR FOUR YEARS

EVERY day for four years, Dr. John D. Brock, Kansas City, Mo. fly enthusiast has taken his plane off the ground at least once. His zeal is a flight a day for ten years. His 1461 consecutive flying days have included stormy, sunny, cold, and hot days. He has flown in high winds and in fog. Recently when he broke the four year mark of his unique record attempt, a group of other "midget" pilots accompanied him on a four state flight.

500,000-WATT STATION IN REGULAR SERVICE

REQ-1-F for permission to operate its giant new 500,000 watt transmitter has been made by station WLW in Cincinnati of the Federal Radio Commission. Night and day tests, conducted for several months, have shown that its programs have been heard in many sections where static and interference made reception impossible in the past. Reports also indicate that it caused no interference with other stations.

[illegible]New Model
k

Experience considered this is undoubtedly the amateur's best value available today.

[illegible]

and **PAGE MAKE FREE** Advertisers With The Make-up, we stand behind any 48 hour money back guarantee. So if you are not 100% satisfied with Make-Up Roger's hair, makeup and hair spray, we'll give you a full refund. No questions asked. We stand behind our products with a 48 hour money back guarantee. So if you are not 100% satisfied with The Make-up, we'll give you a full refund. No questions asked. We stand behind our products with a 48 hour money back guarantee.

MAIL THIS COUPON TODAY

BAUGH & LOMB Optical Co
771 St. Paul St., Rochester, N. Y.

Please send free literature describing your complete equipment for accurate microscopy.

Now _____

Address _____

BAUSCH & LOMB

TO PROTECT BOXES

"61"

FLOOR VARNISH

PRATT & LAMBERT VARNISH PRODUCTS

Motor-Driven Shop Tools

New 1934 line of Delta Shop Tools includes such tools as: Band Saws, Circular Saws, Lathe, Drill Press, Moulding Cutters, Scroll Saws, a Planer, Router, and more. Send TODAY for FREE color catalog and details of the new line. Delta Manufacturing Co., 8778 W. Holtz St., Dept. B-734, Milwaukee, Wis.

FIRST AID FOR CUTS

At the first sign of a cut, scratch or broken blister, guard against the dangers of infection. Do as your doctor does. Completely paint and protect the wound with Iodine—nothing is as effective. This scientific germ-killer and quick-healing agent costs so little. Don't fail to keep a bottle of Iodine handy for every emergency. For sale at any drug store. For free instructive bulletins on the many uses of Iodine, including Athlete's Foot, mail coupon below.

FREE Iodine Educational Bureau, Inc., 120 Broadway, New York City. Please send free booklet: The Many Uses of Iodine.

Name _____

Address _____

City _____ State _____

COMPLETE ELECTRIC PLANTS

\$99

ONAN A. C. PLANTS

SIZES 300 WATTS UP

D. W. ONAN & SONS

313 Royalton Ave., Minneapolis 4, Minn.

Make Beautiful Furniture

at a fraction of the

at a fraction of the

at a fraction of the

Big 72 Page Catalog F—full of Bargains

Home woodworking tools, color illustrations, ideas, how-to, secrets, etc. Send for it today. FREE with 5¢ purchase. W. S. P. All Over the World. Craftsman Wood Service Company, 2729 Mary Street, Chicago, Ill.

Construction Kits

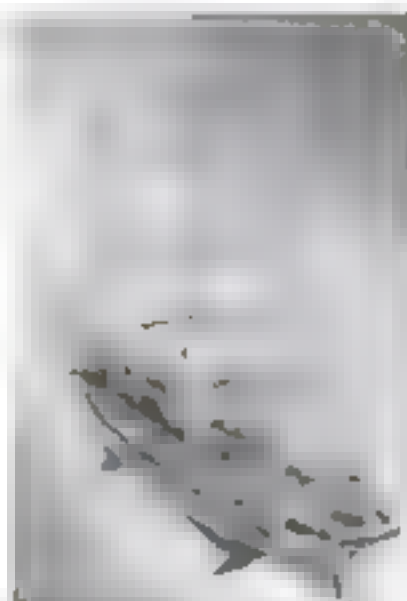
WILL INSURE YOUR SUCCESS



KIT F—Materials for 12-in. model of Monaghan



KIT H



The historic Hartford—KIT L



KIT D



TO BUILD a successful ship model or piece of furniture, you need first of all a good design. Next you must have clear, easily understood plans; and, in the case of ship models, they should be full size. You also require high-grade materials suitable for the work. Finally if you have only a few tools and no motorized equipment, you should have the necessary machine operations on furniture done for you by an expert—that is, the turning, boring, mortising, and shaping.

Our construction kits have been designed to give you just what you require in all these respects. They provide in a single package all the materials necessary to make any one of a number of ship models and pieces of furniture. The materials are of the finest quality, there is no waste, and you do not have to buy a larger quantity of anything than is actually required.

A variety of ship model construction kits are available, ranging from such small and simple models as the *Monaghan* and the *Indianapolis* to the large and impressive model of Farragut's flagship, the sloop-of-war *Hartford*, which is 41 in. long over all.

The ship model kits contain only the raw materials, although in several of them a certain amount of preliminary shaping has been

done on the hulls. In our furniture kits, however, the turning, boring, and other machine operations have been completed. All that remains to be done is the necessary hand finishing and assembling.

All kits are accompanied by instructions or blueprints. The list of our construction kits, which are complete in every particular and will save you much time and effort, is given on this, and the following, page.

- A. Whaling Ship model *Wanderer*. All the raw materials (except paints), Blueprints Nos. 151 to 154, and a booklet. The hull is 20 1/2 in. long. 6.90
- AA. Same with hull kits sawed. 7.40
- D. Spanish galleon ship model. 24 in. long. All the raw materials (except paints), Blueprints Nos. 46 and 47 and a booklet. 6.45
- DD. Same with hull blocks shaped. 6.95
- E. Battleship (model U.S.S. *Texas*), 3 ft. long. All the raw materials (except paints) and Blueprints Nos. 197 to 200. 6.95
- EE. Same with hull kits sawed. 7.45



KIT G



NO. 5



KIT J

Materials for a model of a luxury clipper ship



NO 2

KIT A



F. Liner *Manhattan*. All raw materials (except paints) for a simplified miniature model 12 in. long and Blueprint No. 204. 1.00

G. F. another galleon *Revenge*. All raw materials (except paints) for a model 25 in. long and Blueprints Nos. 206 to 209. 6.75

GG. Same with hull blocks shaped. 7.25

H. Cruiser U.S.S. *Indiana*. All raw materials (with enameled) for a simplified 12-in. model, and Blueprint No. 216. 1.50

J. Clipper ship *Sea Witch*. All raw materials (except paints) for a simplified 13 in. model, with blueprint. 1.50

L. Farragut's flagship *Hartford*, a steam and sail ship-of-war. All raw materials (except paints) and special Blueprints Nos. 211 and 212. The hull is 33 1/2 in. long, and the over-all length is 41 in. 7.04

LL. Same with hull lifts sawed. 8.45

No. 2. Solid mahogany tray-top table 23 in. high with a 15 in. diameter top. Ready to assemble, but without finishes. 5.40

No. 4. Solid mahogany book trough 22 1/2 in. long, 9 1/2 in. wide, and 24 1/2 in. high over all. Ready to assemble, with finishes. 5.30

No. 5. Solid rock maple hanging wall rack with one drawer, 19 1/2 in. wide, 33 1/2 in. high. Ready to assemble and stain included. 5.75

No. 6. Solid rock maple butterfly table top 14 by 22 in., height 22 1/2 in. Ready to assemble and stain included. 6.90

Popular Science Homecraft Guild,
381 Fourth Avenue, New York, N. Y.
Please send me Kit _____ for
which I inclose \$_____. (or send C. O. D. ☐)

Name _____

Address _____

City _____ State _____

(Please print name very clearly.)

Note: Prices of all kits except F, H and J are 50 cents higher west of the Mississippi River because of heavy shipping charges. We prepay the cost on both cash orders and C. O. D. orders. On all C. O. D. orders you will have to pay on delivery the extra charges made by the Post Office, which amount to 25 cents. Kits F, H and J cannot be sent C. O. D. This offer is made only in the United States.

ONE STEP from Your Train TWO STEPS from Anywhere



When you get off your train in Cleveland's Union Terminal, say "Hotel Cleveland" to the redcap—and you're in the lobby in a moment—no time or taxi fare needed. • At this Hotel, all Cleveland is at your doorstep. Whether you come for business or pleasure, you are nearer more of the places you'll want to see than you would be in any other hotel. • But convenience isn't all you find here. The food is exceptional. Prices of everything are moderate. Furnishings are luxurious. And there's something that's hard to define—an atmosphere, a friendliness, a genuine interest in your comfort...it never appears on the bill, but it's worth a lot to any man or woman away from home.



• Near best restaurants
• Near best shopping
• Near best sightseeing
• Near best entertainment
• Near best business
• Near best transportation
• Near best everything

HOTEL CLEVELAND

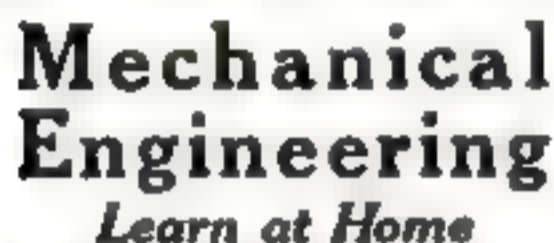
8 BLANK REVOLVER

DOUBLE ACTION
SAFE and HARMLESS


4.95

• Shot & A. Blank U. S. 12 GA. 1.00
• Shot & A. Blank U. S. 10 GA. 1.00
• Shot & A. Blank U. S. 8 GA. 1.00
• Shot & A. Blank U. S. 6 GA. 1.00
• Shot & A. Blank U. S. 4 GA. 1.00
• Shot & A. Blank U. S. 2 GA. 1.00
• Shot & A. Blank U. S. 1 GA. 1.00
• Shot & A. Blank U. S. 1/2 GA. 1.00
• Shot & A. Blank U. S. 1/4 GA. 1.00
• Shot & A. Blank U. S. 1/8 GA. 1.00
• Shot & A. Blank U. S. 1/16 GA. 1.00
• Shot & A. Blank U. S. 1/32 GA. 1.00
• Shot & A. Blank U. S. 1/64 GA. 1.00
• Shot & A. Blank U. S. 1/128 GA. 1.00
• Shot & A. Blank U. S. 1/256 GA. 1.00
• Shot & A. Blank U. S. 1/512 GA. 1.00
• Shot & A. Blank U. S. 1/1024 GA. 1.00
• Shot & A. Blank U. S. 1/2048 GA. 1.00
• Shot & A. Blank U. S. 1/4096 GA. 1.00
• Shot & A. Blank U. S. 1/8192 GA. 1.00
• Shot & A. Blank U. S. 1/16384 GA. 1.00
• Shot & A. Blank U. S. 1/32768 GA. 1.00
• Shot & A. Blank U. S. 1/65536 GA. 1.00
• Shot & A. Blank U. S. 1/131072 GA. 1.00
• Shot & A. Blank U. S. 1/262144 GA. 1.00
• Shot & A. Blank U. S. 1/524288 GA. 1.00
• Shot & A. Blank U. S. 1/1048576 GA. 1.00
• Shot & A. Blank U. S. 1/2097152 GA. 1.00
• Shot & A. Blank U. S. 1/4194304 GA. 1.00
• Shot & A. Blank U. S. 1/8388608 GA. 1.00
• Shot & A. Blank U. S. 1/16777216 GA. 1.00
• Shot & A. Blank U. S. 1/33554432 GA. 1.00
• Shot & A. Blank U. S. 1/67108864 GA. 1.00
• Shot & A. Blank U. S. 1/134217728 GA. 1.00
• Shot & A. Blank U. S. 1/268435456 GA. 1.00
• Shot & A. Blank U. S. 1/536870912 GA. 1.00
• Shot & A. Blank U. S. 1/1073741824 GA. 1.00
• Shot & A. Blank U. S. 1/2147483648 GA. 1.00
• Shot & A. Blank U. S. 1/4294967296 GA. 1.00
• Shot & A. Blank U. S. 1/8589934592 GA. 1.00
• Shot & A. Blank U. S. 1/17179869184 GA. 1.00
• Shot & A. Blank U. S. 1/34359738368 GA. 1.00
• Shot & A. Blank U. S. 1/68719476736 GA. 1.00
• Shot & A. Blank U. S. 1/137438953472 GA. 1.00
• Shot & A. Blank U. S. 1/274877906944 GA. 1.00
• Shot & A. Blank U. S. 1/549755813888 GA. 1.00
• Shot & A. Blank U. S. 1/1099511627776 GA. 1.00
• Shot & A. Blank U. S. 1/2199023255552 GA. 1.00
• Shot & A. Blank U. S. 1/4398046511104 GA. 1.00
• Shot & A. Blank U. S. 1/8796093022208 GA. 1.00
• Shot & A. Blank U. S. 1/17592186044416 GA. 1.00
• Shot & A. Blank U. S. 1/35184372088832 GA. 1.00
• Shot & A. Blank U. S. 1/70368744177664 GA. 1.00
• Shot & A. Blank U. S. 1/140737488355328 GA. 1.00
• Shot & A. Blank U. S. 1/281474976710656 GA. 1.00
• Shot & A. Blank U. S. 1/562949953421312 GA. 1.00
• Shot & A. Blank U. S. 1/1125899906842624 GA. 1.00
• Shot & A. Blank U. S. 1/2251799813685248 GA. 1.00
• Shot & A. Blank U. S. 1/4503599627370496 GA. 1.00
• Shot & A. Blank U. S. 1/9007199254740992 GA. 1.00
• Shot & A. Blank U. S. 1/18014398509481984 GA. 1.00
• Shot & A. Blank U. S. 1/36028797018963968 GA. 1.00
• Shot & A. Blank U. S. 1/72057594037927936 GA. 1.00
• Shot & A. Blank U. S. 1/144115188075855872 GA. 1.00
• Shot & A. Blank U. S. 1/288230376151711744 GA. 1.00
• Shot & A. Blank U. S. 1/576460752303423488 GA. 1.00
• Shot & A. Blank U. S. 1/1152921504606846976 GA. 1.00
• Shot & A. Blank U. S. 1/2305843009213693952 GA. 1.00
• Shot & A. Blank U. S. 1/4611686018427387904 GA. 1.00
• Shot & A. Blank U. S. 1/9223372036854775808 GA. 1.00
• Shot & A. Blank U. S. 1/18446744073709551616 GA. 1.00
• Shot & A. Blank U. S. 1/36893488147419103232 GA. 1.00
• Shot & A. Blank U. S. 1/73786976294838206464 GA. 1.00
• Shot & A. Blank U. S. 1/147573952589676412928 GA. 1.00
• Shot & A. Blank U. S. 1/295147905179352825856 GA. 1.00
• Shot & A. Blank U. S. 1/590295810358705651712 GA. 1.00
• Shot & A. Blank U. S. 1/1180591620717411303424 GA. 1.00
• Shot & A. Blank U. S. 1/2361183241434822606848 GA. 1.00
• Shot & A. Blank U. S. 1/4722366482869645213696 GA. 1.00
• Shot & A. Blank U. S. 1/9444732965739290427392 GA. 1.00
• Shot & A. Blank U. S. 1/18889465931478580854784 GA. 1.00
• Shot & A. Blank U. S. 1/37778931862957161709568 GA. 1.00
• Shot & A. Blank U. S. 1/75557863725914323419136 GA. 1.00
• Shot & A. Blank U. S. 1/151115727451828646838272 GA. 1.00
• Shot & A. Blank U. S. 1/302231454903657293676544 GA. 1.00
• Shot & A. Blank U. S. 1/604462909807314587353088 GA. 1.00
• Shot & A. Blank U. S. 1/1208925819614629174706176 GA. 1.00
• Shot & A. Blank U. S. 1/2417851639229258349412352 GA. 1.00
• Shot & A. Blank U. S. 1/4835703278458516698824704 GA. 1.00
• Shot & A. Blank U. S. 1/9671406556917033397649408 GA. 1.00
• Shot & A. Blank U. S. 1/19342813113834066795298816 GA. 1.00
• Shot & A. Blank U. S. 1/38685626227668133590597632 GA. 1.00
• Shot & A. Blank U. S. 1/77371252455336267181195264 GA. 1.00
• Shot & A. Blank U. S. 1/154742504910672534362390528 GA. 1.00
• Shot & A. Blank U. S. 1/309485009821345068724781056 GA. 1.00
• Shot & A. Blank U. S. 1/618970019642690137449562112 GA. 1.00
• Shot & A. Blank U. S. 1/1237940039285380274899124224 GA. 1.00
• Shot & A. Blank U. S. 1/2475880078570760549798248448 GA. 1.00
• Shot & A. Blank U. S. 1/4951760157141521099596496896 GA. 1.00
• Shot & A. Blank U. S. 1/9903520314283042199192993792 GA. 1.00
• Shot & A. Blank U. S. 1/19807040628566084398385987584 GA. 1.00
• Shot & A. Blank U. S. 1/39614081257132168796771975168 GA. 1.00
• Shot & A. Blank U. S. 1/79228162514264337593543950336 GA. 1.00
• Shot & A. Blank U. S. 1/158456325028528675187087900672 GA. 1.00
• Shot & A. Blank U. S. 1/316912650057057350374175801344 GA. 1.00
• Shot & A. Blank U. S. 1/633825300114114700748351602688 GA. 1.00
• Shot & A. Blank U. S. 1/1267650600228229401496703205376 GA. 1.00
• Shot & A. Blank U. S. 1/2535301200456458802993406410752 GA. 1.00
• Shot & A. Blank U. S. 1/5070602400912917605986812821504 GA. 1.00
• Shot & A. Blank U. S. 1/10141204801825835211973625643008 GA. 1.00
• Shot & A. Blank U. S. 1/20282409603651670423947251286016 GA. 1.00
• Shot & A. Blank U. S. 1/40564819207303340847894502572032 GA. 1.00
• Shot & A. Blank U. S. 1/81129638414606681695789005144064 GA. 1.00
• Shot & A. Blank U. S. 1/162259276829213363391578010288128 GA. 1.00
• Shot & A. Blank U. S. 1/324518553658426726783156020576256 GA. 1.00
• Shot & A. Blank U. S. 1/649037107316853453566312041152512 GA. 1.00
• Shot & A. Blank U. S. 1/1298074214633706907132624082305024 GA. 1.00
• Shot & A. Blank U. S. 1/2596148429267413814265248164610048 GA. 1.00
• Shot & A. Blank U. S. 1/5192296858534827628530496329220096 GA. 1.00
• Shot & A. Blank U. S. 1/10384593717069655257060992658440192 GA. 1.00
• Shot & A. Blank U. S. 1/20769187434139310514121985316880384 GA. 1.00
• Shot & A. Blank U. S. 1/41538374868278621028243970633760768 GA. 1.00
• Shot & A. Blank U. S. 1/83076749736557242056487941267521536 GA. 1.00
• Shot & A. Blank U. S. 1/166153499473114484112975882535043072 GA. 1.00
• Shot & A. Blank U. S. 1/332306998946228968225951765070086144 GA. 1.00
• Shot & A. Blank U. S. 1/664613997892457936451903530140172288 GA. 1.00
• Shot & A. Blank U. S. 1/1329227995784915872903807060280344576 GA. 1.00
• Shot & A. Blank U. S. 1/2658455991569831745807614120560689152 GA. 1.00
• Shot & A. Blank U. S. 1/5316911983139663491615228241121378304 GA. 1.00
• Shot & A. Blank U. S. 1/10633823966279326983230456482242756608 GA. 1.00
• Shot & A. Blank U. S. 1/21267647932558653966460912964485513216 GA. 1.00
• Shot & A. Blank U. S. 1/42535295865117307932921825928971026432 GA. 1.00
• Shot & A. Blank U. S. 1/85070591730234615865843651857942052864 GA. 1.00
• Shot & A. Blank U. S. 1/170141183460469231731687303715884105728 GA. 1.00
• Shot & A. Blank U. S. 1/340282366920938463463374607431768211456 GA. 1.00
• Shot & A. Blank U. S. 1/680564733841876926926749214863536422912 GA. 1.00
• Shot & A. Blank U. S. 1/1361129467683753853853498429727072845824 GA. 1.00
• Shot & A. Blank U. S. 1/2722258935367507707706996859454145691536 GA. 1.00
• Shot & A. Blank U. S. 1/5444517870735015415413993718908291383072 GA. 1.00
• Shot & A. Blank U. S. 1/10889035741470030830827987437816582766144 GA. 1.00
• Shot & A. Blank U. S. 1/21778071482940061661655974875633165532288 GA. 1.00
• Shot & A. Blank U. S. 1/43556142965880123323311949751266331064576 GA. 1.00
• Shot & A. Blank U. S. 1/87112285931760246646623899502532662129152 GA. 1.00
• Shot & A. Blank U. S. 1/17422457186352049329324779900506524425824 GA. 1.00
• Shot & A. Blank U. S. 1/34844914372704098658649559801013048851648 GA. 1.00
• Shot & A. Blank U. S. 1/69689828745408197317299119602026097703296 GA. 1.00
• Shot & A. Blank U. S. 1/139379657490816394634598239204052195406592 GA. 1.00
• Shot & A. Blank U. S. 1/278759314981632789269196478408104390813184 GA. 1.00
• Shot & A. Blank U. S. 1/557518629963265578538392956816208781626368 GA. 1.00
• Shot & A. Blank U. S. 1/1115037259926531157076785913632417563252736 GA. 1.00
• Shot & A. Blank U. S. 1/2230074519853062314153571827264835126505472 GA. 1.00
• Shot & A. Blank U. S. 1/4460149039706124628307143654529670253010944 GA. 1.00
• Shot & A. Blank U. S. 1/8920298079412249256614287309059340506021888 GA. 1.00
• Shot & A. Blank U. S. 1/17840596158824498513228574618118681012043776 GA. 1.00
• Shot & A. Blank U. S. 1/35681192317648997026457149236237362024087552 GA. 1.00
• Shot & A. Blank U. S. 1/71362384635297994052914298472474724048175104 GA. 1.00
• Shot & A. Blank U. S. 1/142724769270595988105828596944949448096350208 GA. 1.00
• Shot & A. Blank U. S. 1/285449538541191976211657193889898896192700416 GA. 1.00
• Shot & A. Blank U. S. 1/570899077082383952423314387779797792385400832 GA. 1.00
• Shot & A. Blank U. S. 1/1141798154164767904846628775559595584770801664 GA. 1.00
• Shot & A. Blank U. S. 1/2283596308329535809693257551119191169541603328 GA. 1.00
• Shot & A. Blank U. S. 1/4567192616659071619386515102238382339083206656 GA. 1.00
• Shot & A. Blank U. S. 1/9134385233318143238773030204476764678166413312 GA. 1.00
• Shot & A. Blank U. S. 1/18268770466636286477546060408953529356332826624 GA. 1.00
• Shot & A. Blank U. S. 1/36537540933272572955092120817907058712665653248 GA. 1.00
• Shot & A. Blank U. S. 1/73075081866545145910184241635814117425331306496 GA. 1.00
• Shot & A. Blank U. S. 1/146150163733090291820368483271628234850662612992 GA. 1.00
• Shot & A. Blank U. S. 1/292300327466180583640736966543256469701325225984 GA. 1.00
• Shot & A. Blank U. S. 1/584600654932361167281473933086512939402650451968 GA. 1.00
• Shot & A. Blank U. S. 1/1169201309864722334562947866173025878805300903936 GA. 1.00
• Shot & A. Blank U. S. 1/2338402619729444669125895732346051757610601807872 GA. 1.00
• Shot & A. Blank U. S. 1/4676805239458889338251791464692103515221203615744 GA. 1.00
• Shot & A. Blank U. S. 1/9353610478917778676503582929384207030442407231488 GA. 1.00
• Shot & A. Blank U. S. 1/18707220957835557353007165858768414060884814462976 GA. 1.00
• Shot & A. Blank U. S. 1/37414441915671114706014331717536828121769628925952 GA. 1.00
• Shot & A. Blank U. S. 1/74828883831342229412028663435073656243539257851904 GA. 1.00
• Shot & A. Blank U. S. 1/149657767662684458824057326870147312487078515703808 GA. 1.00
• Shot & A. Blank U. S. 1/299315535325368917648114653740294624974157031407616 GA. 1.00
• Shot & A. Blank U. S. 1/598631070650737835296229307480589249948314062815232 GA. 1.00
• Shot & A. Blank U. S. 1/1197262141301475670592458614961178499896628125630464 GA. 1.00
• Shot & A. Blank U. S. 1/2394524282602951341184917229922356999793256251260928 GA. 1.00
• Shot & A. Blank U. S. 1/4789048565205902682369834459844713999586512502521856 GA. 1.00
• Shot & A. Blank U. S. 1/9578097130411805364739668919689427999173025005043712 GA. 1.00
• Shot & A. Blank U. S. 1/19156194260823610729479337399378855998346050010087424 GA. 1.00
• Shot & A. Blank U. S. 1/38312388521647221458958674798757711996692100020174848 GA. 1.00
• Shot & A. Blank U. S. 1/76624777043294442917917349597515423993384200040349696 GA. 1.00
• Shot & A. Blank U. S. 1/153249554086588885835834699195030847986768400080699392 GA. 1.00
• Shot & A. Blank U. S. 1/306499108173177771671669398390061695973536800161398784 GA. 1.00
• Shot & A. Blank U. S. 1/612998216346355543343338796780123391947073600322797568 GA. 1.00
• Shot & A. Blank U. S. 1/1225996432692711086686677593560246783894147200645595136 GA. 1.00
• Shot & A. Blank U. S. 1/2451992865385422173373355187120493567788294401291190272 GA. 1.00
• Shot & A. Blank U. S. 1/4903985730770844346746710374240987135576588802582380544 GA. 1.00
• Shot & A. Blank U. S. 1/9807971461541688693493420748481974271153177605164761088 GA. 1.00
• Shot & A. Blank U. S. 1/19615942922883377386986841496963948542306355210329522176 GA. 1.00
• Shot & A. Blank U. S. 1/39231885845766754773973682993927897084612710420659044352 GA. 1.00
• Shot & A. Blank U. S. 1/78463771691533509547947365987855794169225420841318088704 GA. 1.00
• Shot & A. Blank U. S. 1/156927543383067019095894731975711588338450841682636177408 GA. 1.00
• Shot & A. Blank U. S. 1/313855086

STORIES THAT WILL HELP YOU GET AHEAD



【例 1】下列各数中，与 1 最接近的数是（ ）。



STRING TENNIS RACKETS

FINEST QUALITY GILK STRINGS

Complete stringing outfit \$7
 16 hole stringing green room
 gain etc. 1.50 postpaid
 Free Catalogue and instructions

75¢
 per set
 (postpaid)

Manufacturers & Importers

YANKEE TENNIS RACKET CO.

150 W. 125 ST. NEW YORK CITY

LEARN AT HOME

Lebanon Extension University, Dept. 753-L, Chicago

B. Sc. Degree in Civil, Elec.

174 College Ave. Angola, Ind.

**for the BIG PAY JOBS
"AVIATION"**

Writings of the late Rev. J. W. Alden, D.D., President of the University of Michigan, 1847-1854. 1854. 12mo. 1 vol. 100 pp. \$1.00.

2138 Aircraft Bldg. Lincoln, Neb.

**A broad, basic, intensive course
Complete in One School Year**

†† **የጥቅምት 4ኛው** ስራ ስለ ተጀምሮ የሰዓቱ ስራው የጥቅምት 4ኛው ስራው

107 Takoma Ave., Washington, D.C.

At 9 am, A postcard from Washington D.C. to [redacted] containing terms of sale at home. Organized members [redacted] [redacted] [redacted]

The Termin Equipment Co. Trenton, N. J.

100% Improved Guaranteed
We build strength on the inside.

PROJECT VOICE INSTITUTE, Station A 230
300 N. Michigan Ave. - Chicago

FINDS IT PROFITABLE TO LET PUBLIC WATCH

(Continued from Dec. 1980)

the business will percolate back to me

—H. W. Y., Portland, Oregon

ALTER, INC.

only alternative

a little New Mexico village

gave me an idea

bench at a sitting (Continued from 102)



Highway Engineer
Lawyer
Electrical Engineer

二、如何保证产品质量

Author's address:

The Job You

Opportunities

your employer

satisfactorily

for the Job You Want?

helped in "cash in" on their training.

...and the ...

that interests you and let us send you full information.

The University of the Home

Learn at Home-Make Good Money

Warning may gradually diminish but may still be felt 2-4 days after M block.

4 And we last free birth. It is Remond to Mother This
4 does not challenge me. It is not just given.

Year	Age
------	-----

Case	Ref.
1. C. 40	Ref. 1

One Year From Today What Will You Be Earning?

This may be the most important year in your life! Your whole future is apt to depend on how you take advantage of present business changes.

The "New Deal" is opening up new jobs, creating unusual opportunities, bringing back prosperity. But that does not insure prosperity for you. Only you can insure that.

For months—maybe years—employers will be able to pick and choose out of the millions now unemployed or dissatisfied with their work and pay. Naturally they will pick the men with most preparation and ability.

You should—you must—make yourself quickly more valuable—to protect what you have and to insure getting your share of the promotions and pay raises. It is being done by OTHERS—it can be done by YOU!

Ask us to send you full details about our new spare time training, and to explain how it prepares you to meet today's demands and opportunities, also about our salary-increasing plan. If you really are in earnest, you should investigate at once. Check your field below, write your name and address, and mail.

LaSalle Extension University Dept. 783-R Chicago

Send me, free, the facts about the demands and opportunities in the business field I have checked—and about your training for that field.

- | | |
|---|--|
| <input type="checkbox"/> Higher Accounting | <input type="checkbox"/> Industrial Management |
| <input type="checkbox"/> Expert Bookkeeping | <input type="checkbox"/> Modern Foremanship |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Law—LL.B. Degree |
| <input type="checkbox"/> C. P. A. Coaching | <input type="checkbox"/> Commercial Law |
| <input type="checkbox"/> Grocery Store Management | <input type="checkbox"/> Stenography |
| <input type="checkbox"/> Modern Salesmanship | <input type="checkbox"/> Effective Speaking |

Name _____

Present Position _____

Address _____

LEARN ELECTRICITY



Pay for Training AFTER YOU GRADUATE

I'm making an offer no other school ever dared make. You can learn to be an electrician, learn the best money-making trade in America, and you pay for your training only after you graduate. This is YOUR OPPORTUNITY.

TWELVE WEEKS OF SHOP TRAINING
Come to Chicago and learn Electricity the quick and the easy way—by actual work on actual equipment and the latest. No useless theory. The average time to complete the course is only 12 weeks. No previous experience necessary. Good jobs—real pay—guaranteed.

Free Employment Service

We employ three men on a full-time basis whose sole job is to help you find a job. We find out what you want to do, and we find you a job. We guarantee you a job or we pay for your training. No other school can do this. On the first day of your training, we will give you a FREE COPY OF "HOW TO GET A JOB" and my new offer.

COYNE Electrical SCHOOL

300 S. Paulina St., Dept. E-4-73, Chicago

COYNE ELECTRICAL SCHOOL, M. C. Lewis, Pres.

300 S. Paulina St., Dept. E-4-73, Chicago, Ill.

Send your Free Book and special offer to get the best training in any monthly payments after I graduate.

Name _____

Address _____

City _____

State _____

Zip _____

Phone _____

Mail _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

Other _____

Signature _____

Date _____

Enclosure _____

Postage _____

Insurance _____

SEWING TABLE BUILT WITH FEW TOOLS

ALTHOUGH motor-driven workshops are becoming more popular every day, many home craftsmen still do not have these facilities. The sewing table shown in the accompanying illustrations was designed for those with limited shop facilities, and the construction requires only such tools as may be found in almost any household. Red gum, which was used for the original table, is an excellent wood to choose since it is easy to work and takes a beautiful finish, however, the builder may suit himself as to materials.

Begin with the legs which are shown in detail. These usually may be purchased already squared at the local lumberyard. After the legs have been made, sand each leg well with medium and fine sandpaper.

Before cutting the mortises in the legs, make the end and back rails. The mortises are marked on the legs direct from the tenons on the rails, thus assuring a neat fit. Section A-A shows how the tenons are mitered where they meet in the back legs.

The method of fastening the front rails is indicated in the drawings. The upper rail has a dovetail tenon, which makes a sturdy joint.

The design for the brackets under the lower front rail is shown on squares for easy enlargement. By marking off a number of 1/2-in. squares on a piece of cardboard, the de-



This useful little table, the charm of which is its simplicity, requires no machine work.

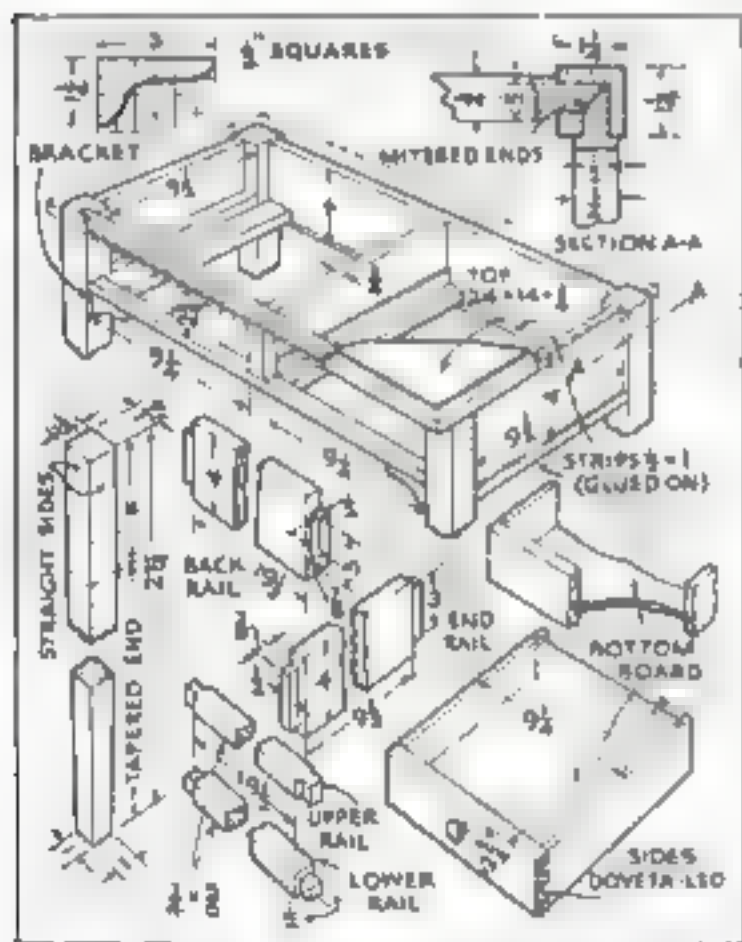
sign may be drawn full size; it is then cut out and marked on the wood.

After all the parts have been cut and sanded, the ends are glued up. The ends are then joined by the back and front rails. If necessary, corner blocks the thickness of the front rails may be glued and screwed in place. The brackets under the lower front rail are held with glue and brads.

The assembly drawing shows the construction of the drawer slides, which are secured by means of glue, screws, and brads, and details are given of the drawer construction. The sides of the drawers are cut out first and then marked on the front so the dovetails can be laid out. The grooves of the bottom are cut out with a narrow chisel. The parts are fastened with glue and brads except the bottom, which is held by the grooves.

The recess around the edge of the top may be marked with a marking gauge or with a square and a sharp knife. Cut out the marked part with a chisel, and sand well, holding the sandpaper on a block. The top is fastened on with four angle irons, or if corner blocks are used, drive screws up through these.

For the finish, apply a coat of good stain of the desired color. After the stain has dried thoroughly, sand lightly and apply two or three coats of shellac sanding lightly between coats. As the final finish rub the last coat of shellac with very fine steel wool until satiny. —W. L. DUBBAN, E.



How the parts are made and assembled. The central dividing rail is mortised or doweled into the back.

REMOVING SEPARATE EXPOSURES FROM A ROLL FILM

THE popularity of cut film and plate cameras is due in part to the convenience of being able to remove individual exposures for development at any time. This can also be done with cameras using roll film where a dark closet is available. First cut a piece of adhesive tape to the width of the film used. In a dark room or closet, remove the camera cover and with scissors make a slight nick in the film where the last of the exposed portion has passed over the roller. Remove the take-up spool and cut across the film, but not

the backing paper. The exposed film can then be easily disengaged and placed in a light-tight box. Fasten the end of the unexposed film down to the backing paper with the strip of adhesive tape and replace it in the camera. The entire operation takes but a minute and is not difficult to do. The position of the remainder of the film can be checked by taking the camera into the light, after re-attaching the cover, and seeing that the correct number for the next exposure appears in the red window.—E. N. N.

"THERE'S ONE MAN WE'RE GOING TO KEEP"



"To Winans, there is one of the most ambitious men in the plant," but he never looks away from his work. He uses his lateral and Correspondence Schools to use every chance he gets.

"It's been the making of him too. He hasn't been here nearly as long as Tom Dorney who was and is yesterday, but he knows ten times as much about this business."

"I'm going to give him Tom's job at a raise in salary," says the kind of man we want around here."

How would you like to see you on the list of winners of a Tom Dorney? A little going isn't it, eh?

No matter where you are, the Junior and Correspondence Schools will help you. No matter what your business, it will show you the way to a better job. No matter how far you are from a school, you can study at home. No matter how busy you are, you can study at night. No matter how old you are, you can study at any time.

This is all we ask. Without cost, without obligation, without any other conditions, just let us know how we can help you and mark and mail this coupon.

INTERNATIONAL CORRESPONDENCE SCHOOLS

"The Universal University," Box 5694-C, Scranton, Penna. Without cost or obligation, please send me a copy of your booklet "Who We Are and Why," and full particulars about the scope of your school. I will mark X.

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|--|---|
| <input type="checkbox"/> Architect
<input type="checkbox"/> Air Conditioning Drafting
<input type="checkbox"/> Blue Print Reading
<input type="checkbox"/> Mechanical Drafting
<input type="checkbox"/> Electrical Drafting
<input type="checkbox"/> Civil Engineering
<input type="checkbox"/> Mechanical Engineering
<input type="checkbox"/> Chemical Engineering
<input type="checkbox"/> Industrial Engineering
<input type="checkbox"/> Mining Engineering
<input type="checkbox"/> Petroleum Engineering
<input type="checkbox"/> Textile Engineering
<input type="checkbox"/> Food Engineering
<input type="checkbox"/> Paper Engineering
<input type="checkbox"/> Rubber Engineering
<input type="checkbox"/> Leather Engineering
<input type="checkbox"/> Glass Engineering
<input type="checkbox"/> Ceramic Engineering
<input type="checkbox"/> Metallurgical Engineering
<input type="checkbox"/> Chemical Engineering
<input type="checkbox"/> Industrial Engineering
<input type="checkbox"/> Mining Engineering
<input type="checkbox"/> Petroleum Engineering
<input type="checkbox"/> Textile Engineering
<input type="checkbox"/> Food Engineering
<input type="checkbox"/> Paper Engineering
<input type="checkbox"/> Rubber Engineering
<input type="checkbox"/> Leather Engineering
<input type="checkbox"/> Glass Engineering
<input type="checkbox"/> Ceramic Engineering
<input type="checkbox"/> Metallurgical Engineering | <input type="checkbox"/> Bridge Engineering
<input type="checkbox"/> Automobile Work
<input type="checkbox"/> Heating, Power, Piping
<input type="checkbox"/> Ventilation
<input type="checkbox"/> Air Conditioning
<input type="checkbox"/> Machine Design
<input type="checkbox"/> Machine Shop
<input type="checkbox"/> Machine Drawing
<input type="checkbox"/> Machine Tooling
<input type="checkbox"/> Machine Maintenance
<input type="checkbox"/> Machine Repair
<input type="checkbox"/> Machine Inspection
<input type="checkbox"/> Machine Testing
<input type="checkbox"/> Machine Lubrication
<input type="checkbox"/> Machine Safety
<input type="checkbox"/> Machine Hygiene
<input type="checkbox"/> Machine Environment
<input type="checkbox"/> Machine Ergonomics
<input type="checkbox"/> Machine Psychology
<input type="checkbox"/> Machine Sociology
<input type="checkbox"/> Machine Anthropology
<input type="checkbox"/> Machine Linguistics
<input type="checkbox"/> Machine Literature
<input type="checkbox"/> Machine Art
<input type="checkbox"/> Machine Music
<input type="checkbox"/> Machine Religion
<input type="checkbox"/> Machine Philosophy
<input type="checkbox"/> Machine Ethics
<input type="checkbox"/> Machine Law
<input type="checkbox"/> Machine Medicine
<input type="checkbox"/> Machine Dentistry
<input type="checkbox"/> Machine Pharmacy
<input type="checkbox"/> Machine Veterinary
<input type="checkbox"/> Machine Agriculture
<input type="checkbox"/> Machine Forestry
<input type="checkbox"/> Machine Fishing
<input type="checkbox"/> Machine Hunting
<input type="checkbox"/> Machine Gardening
<input type="checkbox"/> Machine Cooking
<input type="checkbox"/> Machine Sewing
<input type="checkbox"/> Machine Tailoring
<input type="checkbox"/> Machine Shoemaking
<input type="checkbox"/> Machine Hairdressing
<input type="checkbox"/> Machine Cosmetology
<input type="checkbox"/> Machine Beauty
<input type="checkbox"/> Machine Fashion
<input type="checkbox"/> Machine Design
<input type="checkbox"/> Machine Illustration
<input type="checkbox"/> Machine Photography
<input type="checkbox"/> Machine Film Making
<input type="checkbox"/> Machine Animation
<input type="checkbox"/> Machine Sound
<input type="checkbox"/> Machine Music
<input type="checkbox"/> Machine Dance
<input type="checkbox"/> Machine Theater
<input type="checkbox"/> Machine Radio
<input type="checkbox"/> Machine Television
<input type="checkbox"/> Machine Motion Pictures
<input type="checkbox"/> Machine Comics
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Relaxation
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
<input type="checkbox"/> Machine Entertainment
<input type="checkbox"/> Machine Recreation
<input type="checkbox"/> Machine Leisure
<input type="checkbox"/> Machine Health
<input type="checkbox"/> Machine Fitness
<input type="checkbox"/> Machine Sports
<input type="checkbox"/> Machine Games
<input type="checkbox"/> Machine Toys
<input type="checkbox"/> Machine Amusement
 |
|--|---|



Why worry and suffer with that rupture any longer? Learn about my perfected invention. It has brought ease, comfort and happiness to thousands by assisting in relieving and curing many cases of seductive hernia. It has Automatic Air Cushions which bind and draw the broken parts together so you would a broken limb. No obnoxious springs or pads. No knives or plasters. Durable, cheap.

H. C. BROOKS
651 State St.,
Marshall, Mich.

What strange powers did the soul seek possess? Where was the source of knowledge that made it possible for them to perform miracles? Were there profound secrets buried with ancient Hieroglyphs, or had they turned inward, struggling female wills?

These wine men of the past have the reputation
of big, and generous people. This modern man has
lost it. It is withheld from the drink. It is withheld
freely TO YOU if with an open mind you
wish to step out of the old of man-made
misfortune and LASTER TORMENT.

John's introduction has at times sought his audience from the face of the earth, yet most brotherhoods have preserved his sacred wisdom of the ages. The Romanians, one of those ancient brotherhoods, **REVEAL** YOU to wisdom and security in a free copy of the "Wise Men of the Sages. It will point out how you may secure age-old truths. You can begin to **ENLARGE YOUR LIFE NOW!**—the fulfillment of your deepest desire now. Address: **ENLARGE**

Lucian Brotherhood
(AMOSC) California

49^c

Kamtek carries a full line of chemicals at \$2 to \$5th and Medical Grades as low as 5¢-10¢ per container. Our products are unconditional guaranteed. Professional laboratory apparatus at remarkably low prices. Buy direct from our factory. Write for FREE information or send \$2 in stamps to cover cost and get our valuable LATEST APPARATUS CATALOG.

Always mention POPULAR SCIENCE MONTHLY when answering advertisements in this magazine.

(Continued from page 61)

4. An interesting experiment showing how heating may decompose a substance can be performed with some sal ammoniac (ammonium chloride). Being produced when hydrochloric acid gas comes in contact with ammonia gas, it can be made to break apart again by applying heat.

IN A few seconds, the ammonium chloride will begin to decompose to form hydrochloric acid gas and ammonia gas. Being lighter than the hydrochloric acid gas, the ammonia will diffuse, spread, or travel faster and will issue from the open end of the tube nearest the porous plug. The presence of the gas can be shown by holding a moist strip of red litmus paper near the mouth of the tube until it turns blue. Similarly, the hydrochloric acid gas will issue from the other end of the tube and will give evidence of its presence by coloring damp blue litmus red.

(Continued from page 48)

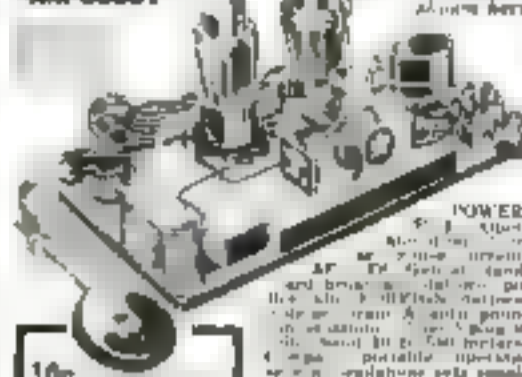
A simple experiment with a bar magnet and a small magnetic compass serves a double purpose in this connection. It fixes the principle in mind and actually illustrates how the rarified matter in the comet's tail is repelled by the sun's light.

Another outstanding point of interest about comets is the manner in which they are captured and held prisoners by the large outlying planets of our solar system, particularly by Jupiter.

That Jupiter is efficient as a comet-catcher is evidenced by the fact that it has eighteen giant planets each of which was once a wandering and homeless comet.

Only one out of the hundred
 400,000

60



10c. 11. 12. 13. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31. 32. 33. 34. 35. 36. 37. 38. 39. 40. 41. 42. 43. 44. 45. 46. 47. 48. 49. 50. 51. 52. 53. 54. 55. 56. 57. 58. 59. 60. 61. 62. 63. 64. 65. 66. 67. 68. 69. 70. 71. 72. 73. 74. 75. 76. 77. 78. 79. 80. 81. 82. 83. 84. 85. 86. 87. 88. 89. 90. 91. 92. 93. 94. 95. 96. 97. 98. 99. 100. 101. 102. 103. 104. 105. 106. 107. 108. 109. 110. 111. 112. 113. 114. 115. 116. 117. 118. 119. 120. 121. 122. 123. 124. 125. 126. 127. 128. 129. 130. 131. 132. 133. 134. 135. 136. 137. 138. 139. 140. 141. 142. 143. 144. 145. 146. 147. 148. 149. 150. 151. 152. 153. 154. 155. 156. 157. 158. 159. 160. 161. 162. 163. 164. 165. 166. 167. 168. 169. 170. 171. 172. 173. 174. 175. 176. 177. 178. 179. 180. 181. 182. 183. 184. 185. 186. 187. 188. 189. 190. 191. 192. 193. 194. 195. 196. 197. 198. 199. 200. 201. 202. 203. 204. 205. 206. 207. 208. 209. 210. 211. 212. 213. 214. 215. 216. 217. 218. 219. 220. 221. 222. 223. 224. 225. 226. 227. 228. 229. 230. 231. 232. 233. 234. 235. 236. 237. 238. 239. 240. 241. 242. 243. 244. 245. 246. 247. 248. 249. 250. 251. 252. 253. 254. 255. 256. 257. 258. 259. 260. 261. 262. 263. 264. 265. 266. 267. 268. 269. 270. 271. 272. 273. 274. 275. 276. 277. 278. 279. 280. 281. 282. 283. 284. 285. 286. 287. 288. 289. 290. 291. 292. 293. 294. 295. 296. 297. 298. 299. 300. 301. 302. 303. 304. 305. 306. 307. 308. 309. 310. 311. 312. 313. 314. 315. 316. 317. 318. 319. 320. 321. 322. 323. 324. 325. 326. 327. 328. 329. 330. 331. 332. 333. 334. 335. 336. 337. 338. 339. 340. 341. 342. 343. 344. 345. 346. 347. 348. 349. 350. 351. 352. 353. 354. 355. 356. 357. 358. 359. 360. 361. 362. 363. 364. 365. 366. 367. 368. 369. 370. 371. 372. 373. 374. 375. 376. 377. 378. 379. 380. 381. 382. 383. 384. 385. 386. 387. 388. 389. 390. 391. 392. 393. 394. 395. 396. 397. 398. 399. 400. 401. 402. 403. 404. 405. 406. 407. 408. 409. 410. 411. 412. 413. 414. 415. 416. 417. 418. 419. 420. 421. 422. 423. 424. 425. 426. 427. 428. 429. 430. 431. 432. 433. 434. 435. 436. 437. 438. 439. 440. 441. 442. 443. 444. 445. 446. 447. 448. 449. 450. 451. 452. 453. 454. 455. 456. 457. 458. 459. 460. 461. 462. 463. 464. 465. 466. 467. 468. 469. 470. 471. 472. 473. 474. 475. 476. 477. 478. 479. 480. 481. 482. 483. 484. 485. 486. 487. 488. 489. 490. 491. 492. 493. 494. 495. 496. 497. 498. 499. 500. 501. 502. 503. 504. 505. 506. 507. 508. 509. 510. 511. 512. 513. 514. 515. 516. 517. 518. 519. 520. 521. 522. 523. 524. 525. 526. 527. 528. 529. 530. 531. 532. 533. 534. 535. 536. 537. 538. 539. 540. 541. 542. 543. 544. 545. 546. 547. 548. 549. 550. 551. 552. 553. 554. 555. 556. 557. 558. 559. 560. 561. 562. 563. 564. 565. 566. 567. 568. 569. 570. 571. 572. 573. 574. 575. 576. 577. 578. 579. 580. 581. 582. 583. 584. 585. 586. 587. 588. 589. 590. 591. 592. 593. 594. 595. 596. 597. 598. 599. 600. 601. 602. 603. 604. 605. 606. 607. 608. 609. 610. 611. 612. 613. 614. 615. 616. 617. 618. 619. 620. 621. 622. 623. 624. 625. 626. 627. 628. 629. 630. 631. 632. 633. 634. 635. 636. 637. 638. 639. 640. 641. 642. 643. 644. 645. 646. 647. 648. 649. 650. 651. 652. 653. 654. 655. 656. 657. 658. 659. 660. 661. 662. 663. 664. 665. 666. 667. 668. 669. 670. 671. 672. 673. 674. 675. 676. 677. 678. 679. 680. 681. 682. 683. 684. 685. 686. 687. 688. 689. 690. 691. 692. 693. 694. 695. 696. 697. 698. 699. 700. 701. 702. 703. 704. 705. 706. 707. 708. 709. 710. 711. 712. 713. 714. 715. 716. 717. 718. 719. 720. 721. 722. 723. 724. 725. 726. 727. 728. 729. 730. 731. 732. 733. 734. 735. 736. 737. 738. 739. 740. 741. 742. 743. 744. 745. 746. 747. 748. 749. 750. 751. 752. 753. 754. 755. 756. 757. 758. 759. 760. 761. 762. 763. 764. 765. 766. 767. 768. 769. 770. 771. 772. 773. 774. 775. 776. 777. 778. 779. 780. 781. 782. 783. 784. 785. 786. 787. 788. 789. 790. 791. 792. 793. 794. 795. 796. 797. 798. 799. 800. 801. 802. 803. 804. 805. 806. 807. 808. 809. 810. 811. 812. 813. 814. 815. 816. 817. 818. 819. 820. 821. 822. 823. 824. 825. 826. 827. 828. 829. 830. 831. 832. 833. 834. 835. 836. 837. 838. 839. 840. 841. 842. 843. 844. 845. 846

[illegible]

1. The first part of the document is a header section containing the title "THE EFFECTS OF THE 1990S REFORMS ON THE CHINESE ECONOMY" and the author's name "JIANHONG ZHANG".

ALL-STATE TRUCK & EQUIPMENT CO. 1-800-441-1111

CLARK COUNTY, N. C.

Hamilton Security Company
Dept P 2 128 Lockwood Ave New Rochelle, N. Y.

Cash Payments Advanced Writers of Songs
Used and publication secured. Send us
any likely material (Words or Music) for
consideration today. Radio Music Guild,
1850 Broadway, New York.

[illegible]

ENTRANCE • 9000 S. 74th St., Overland Park, KS 66207

Prince
THE LOVE SYMBOL ALBUM

T. J. Macomber Advertising,
 215 E. 1st St., N. W., Wash., D. C.
 and same kind direct
 only. **Junior Press**
 No. 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 383, 384, 385, 386, 387, 388, 389, 390, 391, 392, 393, 394, 395, 396, 397, 398, 399, 400, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410, 411, 412, 413, 414, 415, 416, 417, 418, 419, 420, 421, 422, 423, 424, 425, 426, 427, 428, 429, 430, 431, 432, 433, 434, 435, 436, 437, 438, 439, 440, 441, 442, 443, 444, 445, 446, 447, 448, 449, 450, 451, 452, 453, 454, 455, 456, 457, 458, 459, 460, 461, 462, 463, 464, 465, 466, 467, 468, 469, 470, 471, 472, 473, 474, 475, 476, 477, 478, 479, 480, 481, 482, 483, 484, 485, 486, 487, 488, 489, 490, 491, 492, 493, 494, 495, 496, 497, 498, 499, 500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 511, 512, 513, 514, 515, 516, 517, 518, 519, 520, 521, 522, 523, 524, 525, 526, 527, 528, 529, 530, 531, 532, 533, 534, 535, 536, 537, 538, 539, 540, 541, 542, 543, 544, 545, 546, 547, 548, 549, 550, 551, 552, 553, 554, 555, 556, 557, 558, 559, 560, 561, 562, 563, 564, 565, 566, 567, 568, 569, 570, 571, 572, 573, 574, 575, 576, 577, 578, 579, 580, 581, 582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833,

The "Index" section of the magazine states that the "Index" section of the magazine is a "list of names of persons who have been named in the Index" and that the "Index" section of the magazine is a "list of names of persons who have been named in the Index".

[illegible]

· 112 · 中国农村经济体制改革与农村金融

Popular Science Monthly.
Circulation Manager, 30 4th Avenue, N. Y.

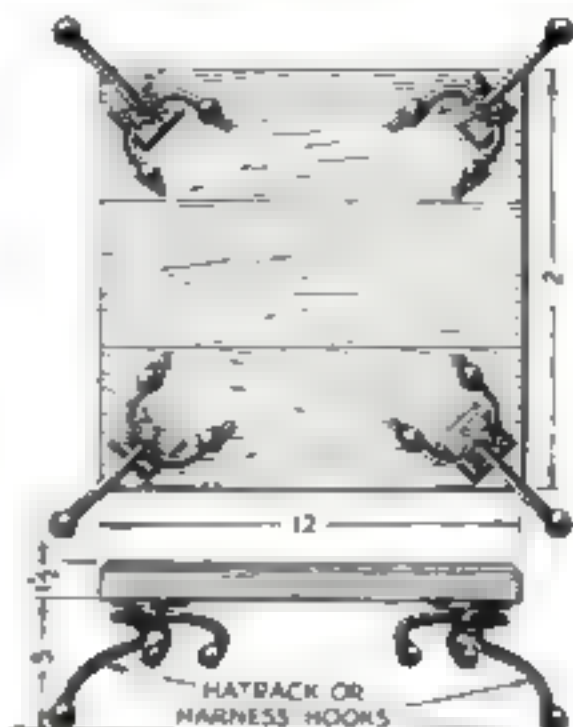
American School
600 W. 31st St.
Chicago, Ill. 60608

COAT HOOKS FORM FEET FOR FOOTSTOOL



Servicable footstool for use on sun porch

FOUR heavy brass hatrack or harness hooks, if of a suitable shape, will serve as feet for a footstool. They are merely screwed to a board about $1\frac{1}{2}$ in. thick and 12 in. square. This board, if hardwood or veneered with hardwood, may be stained and finished with several coats of floor varnish or wax; or, if softwood, it may be padded and covered with a scrap of some durable upholstery material. The footstool illustrated in the photograph above is stained green and used on a sun porch with willow furniture. It is far more durable than ordinary all-wooden footstools.—J. D. C.



BETTER VACATION PICTURE BOOKS

(continued from page 52)

ing-out paper. The number 28 indicates the envelope in which the negative is contained, and 3 the number of the negative in that envelope.

This use of the masks in sketching the dummy assures a pleasing, well-spaced arrangement of the pictures. You know positively where and of what size each picture will be.

As you progress with the dummy, you will want to give full pages to some of your best pictures. To do so will give them excellent display, and serve as well to subdivide the book and introduce variety.

When the dummy has been completed, the work is continued in the darkroom. Technical details of printing or engraving are exactly as usual, except that greater accuracy must be observed. In contact printing, the negative may be secured over the opening with Scotch tape.

Let me insert a word in regard to the selection of paper. A rough surface will absorb the detail of the many small prints, and is not good. A smooth matte takes the lettering easiest and looks very well. Velvet paper has enough luster to give the pictures snap yet does not have the hard coldness of glossy.

If the pages are to be 8 by 10 in., a printing frame of this size is used. When the first negative and the mask are arranged, a test print is exposed. Exposure time must

be so adjusted that the print will have the proper density to exactly the development time recommended by the maker of the paper. Testing each exposure is therefore the only way to be certain that when several pictures are finally printed on the same sheet, they will all be uniform in density.

Having determined this, place the full sheet in the frame and take care that any unused openings in the mask are covered with opaque paper. Each time the separate units are arranged in the frame, mask and paper are tucked into the lower left-hand corner to insure accurate placement. To be sure all pictures will come right side up, indicate the top of the page by a light pencil mark on the back. Develop the page after all pictures, as shown by the dummy, have been exposed.

When the pages have all been printed, they are ready to be tiled and bound. In lettering the titles and ruling borders, waterproof India ink is most easily applied, and it will not become blurred from the moisture of fingers on the gelatin emulsion after the ink has set.

Three methods of binding suggest themselves. Loose-leaf binding is easiest and cheapest. Better, $1\frac{1}{2}$ -in. cloth mending tape may be stuck to the pages as shown in the accompanying drawing, and by this means the whole securely held within the cover with binding posts, which can be obtained at any well-stocked stationery shop. If you are adept at bookbinding, a professional method would be best; or the pages may be sent to a bindery, where the job can be done at moderate cost. If the loose-leaf method is used, leave $\frac{1}{2}$ in. extra margin at the left, if either of the other two methods, center the pictures on the page. A commercial binder, if you turn the work over to him, will hinge the pages, this is a slightly more expensive method, but far superior in that the pages will lie flat as the book is viewed and not tend to flop together. Whether or not the edges are trimmed is a matter of personal choice.

It is advisable to keep the volume in a bookcase as if it were an ordinary book because if it is left carelessly lying around, the pages may show a slight tendency to curl. This tendency can be overcome, if desired, by applying a commercial product sold for making prints lie flat.

SEE OUR FAIR EXHIBIT

If you visit Chicago this summer, do not miss the opportunity to see our exhibit at the World's Fair. Known as the "Mechanical Wonderland," it consists of almost 200 working models that show with amazing clearness the development of all modern machinery.



"If you do not add... 2 INCHES TO YOUR BICEPS 3 INCHES TO YOUR CHEST ... it won't cost you one cent!"

Signed GEORGE F. JOWETT

YES SIR! Two inches of muscle added to your biceps and at least three inches to your chest, or it won't cost you a penny. While my course is not infallible, so many of my pupils have gained tremendous physical development that I am willing to stake my reputation that I can do the same for you. Remember, if I fail it costs you nothing!

Those skinny fellows who are discouraged are the men I want to work with. Many an underweight weakling has come to me for help, completely discouraged. I have developed a real he-man's physique for them, covered his body with layers of muscles, made them strong and proud, eager and ready to face the world with their new power!

Nothing Can Take the Place of My Weight-Resistance Method!

The Jowett System features the weight resistance method that has been tested and endorsed by many of the world's most famous strong men. By using this proven, scientific system of graduated weights, you can quickly develop your muscles and broaden your chest in a powerful proportion!

Take my full course if it does not do all I say. If you are not completely satisfied, and can be the judge, then it won't cost you one penny!



Send for "Building a Mighty Arm"
A Special Course for ONLY 25c
It will be a revelation to you. You can't make a mistake. The reputation of my "Mighty Arm" is so high that the world's athletes behind this name will give out my weight methods of strength development. I have trained and coached men as you like them. I will not limit you to the arm. Try any one of my test exercises, is not below at 25c. Or try all six of them for only \$1.00.

Rush the Coupon TODAY!

Mail your order now and I will include a FREE COPY of NUMBER OF STEEL MUSCLE LINE FROM. It is a practical book to the strength fan and muscle builder. Full of pictures of many famous strong men who show you exactly how you can build symmetry and strength the Jowett Way. Free! Rush this Special Offer.



FREE BOOK WITH PHOTOS OF FAMOUS STRONG MEN

JOWETT INSTITUTE OF PHYSICAL CULTURE

Box, 2000, 422 Poplar St.,
Birmingham, Pa.

George F. Jowett, Your proportion books send to me. Send by return mail, I will send the book as checked below for which I am enclosing—

- ☐ Building a Mighty Arm 25c
- ☐ Building a Mighty Back 25c
- ☐ Building a Mighty Arm 25c
- ☐ Building a Mighty Chest 25c
- ☐ Building a Mighty Leg 25c
- ☐ Strong Man Steps Made Easy 25c
- ☐ All 6 Books for \$1.00.

GEORGE F. JOWETT
Inventor of 400,000
Winner of many medals for his work and physical perfection!

Name _____ Age _____
Address _____



One way to bind the pages. The binding posts begin at the first sheet in front but go through guard and cover at back.

be so adjusted that the print will have the proper density to exactly the development time recommended by the maker of the paper. Testing each exposure is therefore the only way to be certain that when several pictures are finally printed on the same sheet, they will all be uniform in density.

Having determined this, place the full sheet in the frame and take care that any unused openings in the mask are covered with opaque paper. Each time the separate units are ar-



Railway Postal Clerk

START \$1900 a Year

Many Other Government Jobs
 MEN—BOYS 16 to 50
 Many more
 DESIG-NATING
 MAN-POWER

1. **What is the main purpose of the study?**
 2. **What are the research objectives?**
 3. **What is the significance of the study?**
 4. **What is the scope of the study?**
 5. **What are the limitations of the study?**

Student No. _____

BECOME AN EXPERT ACCOUNTANT

[illegible]

Always mention POPULAR SCIENCE MONTHLY when answering advertisements in this magazine.

PATENT YOUR IDEAS

Protect the future profits
from your developments
as 1.5 Patent Delays are
often dangerous to give prompt and PERSONAL
ATTENTION to your case. NOTHING IS EN-
THUS TO UNKILLED ASSISTANTS. The
Patent Office itself urges you to select a Competent
Registered Patent Agent in order to protect your
inventions properly. Therefore, before doing anything

L. EDWARD FLAHERTY
Registered Patent Attorney
Graduate Engineer
WASHINGTON, D.C.

DARE-DEVIL TRICKS THAT WILL MAKE YOUR DRIVING SAFER

STOCKHOLDERS of a British television company at a recent meeting saw and heard their chairman deliver his annual report, but the chairman was in a room several miles away. Television made him visible on a screen in the meeting room and a loudspeaker reproduced his voice which was carried to the hall over telephone wires.

AIR CONDITIONING

THE NEXT BIG INDUSTRY



Its opportunities are as big as winter as in summer. Plumbing and heating engineers must know Air Conditioning the field in its broader aspects invites ambitious men. Write for information on the new up-to-the-minute course on Air Conditioning now offered by the International Correspondence Schools.

... INVENTION—a field of opportunity for men with ideas

If you have an inventive turn of mind, this new course in inventing and patenting will teach you all the basic knowledge you must have to earn real money from your ideas. The coupon will bring information.



CHEMISTRY

a career of service and profit



No field offers greater possibilities today than chemistry. And right at home, in spare time, you can learn the fundamentals by study of the International Correspondence Schools modern course. Today, ask us for complete information.

RADIO holds great rewards for trained men

Almost in a decade radio has become a giant industry. The opportunities created will be enjoyed by trained men. The International Correspondence Schools Radio Course, prepared by leading authorities and constantly revised, will help make you a trained man. A fascinating book—FREE.



INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 493-LA, SCRANTON, PA.

Without obligation, send me full information on subject checked below:

- | | |
|--|---|
| <input type="checkbox"/> Air Conditioning
Heating and Plumbing | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Architecture | <input type="checkbox"/> Highway Engineering |
| <input type="checkbox"/> Mechanical Engineering | <input type="checkbox"/> Printing |
| <input type="checkbox"/> Heating, Ventilation and Air Conditioning | <input type="checkbox"/> English |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Mathematics |
| <input type="checkbox"/> Diesel Engines | <input type="checkbox"/> Accounting |
| <input type="checkbox"/> Gas Engines | <input type="checkbox"/> Shorthand |
| <input type="checkbox"/> Refrigeration | <input type="checkbox"/> Bookkeeping |
| <input type="checkbox"/> Aviation | <input type="checkbox"/> High School Subjects |

Name

Address

Inventions Promoted

Patented or Unpatented. In business over 30 years. Send drawing and description or model, or write for information. Complete facilities. References.

ADAM FISHER MFG. CO.
183-D Enright, St. Louis, Mo.

New Ideas now Solable Before Patenting

Sell your invention without patenting expense. For information, write

Chartered Institute of American Inventors
535 Barrister Building Washington, D. C.
"World's Largest Organization of Inventors"

HOW IS YOUR DRIVING EYE? ASKS GUS

(Continued from page 60)

there was a puzzler until a doctor tested Nevers's eyes. It turned out that Tom had a blind spot that was large enough to blot out a whole car if it was standing in just the right place."

Gosh, if you had a blind spot that large wouldn't you know it? Wouldn't you see a hole in everything you looked at?

Nope, they brought that out at the hearing. We've all got small blind spots, yet we don't see any holes in what we look at," replied Gus as he reached for a piece of paper that lay on the repair bench and fished a pencil out of his overalls pocket.

"HERE, I'll show you how that doctor showed people how to look for their blind spots," he explained as he penciled two small black dots on the paper about three inches apart. "Take this paper in your right hand and hold it so that this dot at the left is in front of your right eye. That's it, only hold it at arm's length with the dots horizontal. Now, close your left eye and look at that left hand dot. You see both dots?"

Townsend indicated that he could. "O. K. Now move the paper toward your right eye slowly and keep on staring at that left dot. All of a sudden, you're going to see that right-hand dot disappear completely. That'll be your blind spot. Then as you move the paper still closer, it'll come back into view again."

Well, I'll be hanged," exclaimed Townsend as he shifted the paper back and forth. "With it held just about here, that right-hand spot fades right out of the picture. Will it work with your left eye?"

"Sure only instead of staring at the left hand dot you want to concentrate on the one at the right. Then the left dot does the disappearing act. By finding out how large the spot can be and still disappear, you can get a rough idea of how large your blind spot is."

As Gus continued his work on the car, Townsend amused himself, testing first one eye and then the other.

"Say," he said finally, "do you suppose I've got a large blind spot and that's what made me run off of the road last night?"

"Maybe," replied Gus. "I'm no eye doctor, but if you can blot out a large spot with that test, it might pay to find out."

"And that reminds me," continued Townsend, interested. "Sometime ago I heard something about tunnel vision. What's that?"

"JUST another eye ailment that can cause a lot of auto accidents," explained Gus. "People with tunnel vision might just as well try to drive a car with a pair of blinders on. If your eyesight is normal, you can see what's going on alongside of you even though you're looking straight ahead. But if you've got tunnel vision, things on the side are just a blank. It's like looking at everything through a pipe or a tunnel."

"Can you do anything with black spots to check up on that tunnel trouble?" asked Townsend.

According to the doctor who tested Nevers's eyes, one of the simplest ways is to hold your index fingers upright back near each ear and then move them forward until you can see them even though you're staring straight ahead. A normal person will notice them as soon as they come opposite the eyes, but a person with tunnel vision won't even begin to see them until they're further out in front. To be a safe automobile driver you ought to be able to see an area in front of your eyes equal at least to 150 degrees even when you're looking ahead.

"But then buzz eyesight isn't the only thing

that makes poor drivers," added Gus. "Nervousness and lack of judgment are close seconds. Have you ever tried to see just how well you really can judge distance? Here's a trick they used to try on student flyers that'll give you some idea. Just hold an ordinary pencil lightly in each hand about a foot from your eyes. Then, starting them horizontal and about two feet apart, see if you can bring the blunt ends together quickly the first time you try.

"AND there's another little stunt you can do with ordinary pins to test your nerves. Take about fifty straight pins and pile them up on a newspaper. Then, with somebody timing you, see how long it takes to transfer those pins, one at a time, to a tin cup. If you call yourself a good driver, you shouldn't have to rush to move the whole fifty in less than a minute and a half."

"Holy smokes," put in Townsend. "If you had your way, only first-class aviators would be driving cars."

"Oh, not as bad as all that," corrected Gus with a smile. "But you'll have to admit there are lots of people driving cars who shouldn't be. And the pity of it is, they drive too fast for their senses."

"Just the other day I was reading an article by a college professor. According to him, it takes the average person about a half a second to see danger and do something about it. Now, in a car going forty miles an hour, a half second is a long time. It can cover over thirty feet in that instant. That means, if you're hopping along a road at forty and suddenly see a car stalled across the road less than thirty feet ahead of you, you're bound to smash into it before you can even begin to do anything about it."

It's speed that causes most bad accidents," warned Gus. "A harmless bump at twenty can be a smash-up at forty. There's a heap of power in a ton of metal hurtled through the air at forty miles an hour."

"What's your idea of a good driver then, a slow poke?" inquired Townsend.

"No, not necessarily. My idea of a good driver is a man who knows himself and his car and isn't in a hurry to get no place to do nothing. When you meet a fellow that's courteous and takes good care of his car, you can bet he's a good driver."

"YOU can't be a good driver and pilot a pile of junk. Trouble is, people think so much of the power and speed of the buggy they're driving and not enough about how quickly it will stop and how well the headlights light up the road without bothering the other fellow. Tires, brakes, horn, lights, and rear vision mirror are just as important as the motor."

Gosh," called Joe Clark as Townsend maneuvered his car out of the driveway. "Why the sermon on safety? You're a garage mechanic, not a policeman. You've probably got that guy so scared he'll have a hard time driving to the next town."

"Well, I'll bet he'll get there without climbing a couple of trees," returned Gus with a smile. "Being cautious and just a little scared never caused any fatal accidents. A swell-headed driver is one nut in a car that you can't fix with a wrench."

VISIT OUR WONDERLAND

THRILLING as ever, POPULAR SCIENCE MONTHLY's Mechanical Wonderland is at the World's Fair again this year. You'll find it worth a visit to the General Exhibits Building, next to the Hall of Science.

This One



CQ5L-8F7-W45P

BARREN ALKALI LANDS NOW MADE FERTILE

(Continued from page 29)

next tried sulphur. Spreading from 1,000 to 3,600 pounds on an acre of land, they plowed it under and lightly irrigated to promote oxidation. The result was the chemical miracle they had sought.

IN A few weeks, the sulphur, as it seeped into the earth was converted into sulphuric acid. This acid in turn dissolved the calcium carbonate, forming calcium sulphate, which in turn made sodium clay into calcium clay from which the salts could be removed by leaching. By these links in a chemical chain, the land was completely reclaimed.

The results were immediately apparent. A single seeding of alfalfa produced two tons an acre the first year, nine tons the second, ten the third, and twelve the fourth. Now the land is in vineyards again, after a lapse of forty years and the soil is normal in every respect. It is the first demonstration in history that vines can grow in once-alkaline soil.

All kinds of sulphur, the experiments revealed, have about the same value in the work. They require approximately six months for the oxidation process to be completed before seeding can begin. In none of the experiments was fertilizer used.

As the Fresno experiment progressed, slightly more than five years ago the three scientists began their attack upon white alkali. Near El Centro, where rainfall averages two to three inches a year, they found a farm so heavily impregnated with salts that the flaky white substances covered the surface in many spots. This Imperial Valley farm, which was succumbing to the march of alkali, had been outstandingly fertile when the Imperial Irrigation District began to bring in water from the Colorado River in 1901.

For two decades, the valley was an area of high productivity. Yet, in 1929, when the three scientists laid out nine experimental plots on the ranch, one sixth of the irrigated area had succumbed to alkali. Again, Thomas, acting as field man, took hundreds of samples of the soil.

The chemical which predominated was calcium. Following a method of treatment similar to that which had succeeded near Fresno, the men spread sulphur and gypsum, singly and in combination, over the experimental plots. In less than two years after they first applied scientific methods of recovery to the land, it was yielding a perfect stand of alfalfa, as well as of other crops.

BUT in the case of the white alkali, they found that draining away the underlying water was more important than treating with chemicals; the reverse of conditions with black alkali. A canal ten feet deep, one of many totaling 150 miles in length, which interlace in the valley and carry off the salt-laden water, proved to be a vital part of the experiment. As the excess water leached the soil, it seeped into this ditch and was carried finally into the Salton Sea.

In order to keep the salts in solution and thus reduce their toxicity, the experimental beds were never allowed to dry out while the alfalfa, cotton, barley, and other crops were getting started. Frequent light irrigations were the rule.

Whereas many farmers get poor stands on good, irrigated land, the scientists got maximum yields on both experimental farms with no skip spots, through their method of preparing the soil and giving it scientific care—a method which provides a simple solution for a world-wide problem.

Nor does this treatment entail great expense. Last season, despite the added costs of applied science and the low prices, crops from the Fresno farm were sold at a profit.

GIANT LIGHTNING ROD PROTECTS POWER LINE

(Continued from page 17)

spirally. The hollow cable, it is contended, has a capacity equal to that of a solid conductor of the same size.

The adoption of a large-diameter cable raised the problem of wind resistance, but extensive wind-tunnel tests at the Harris J. Ryan laboratories at Stanford University showed that the hollow construction of the cable enabled it to withstand heavy wind. More flexible than solid cable, the new conductor is able to damp out vibration to a remarkable degree.

Field studies of the vibration problem were carried out in a highly original manner. Climbing the towers, engineers took motion pictures of the cable as it vibrated under impulses from electric motors. This was accomplished by fixing to the cable a disk containing two pinholes and placing a light behind it. The light, filtering through the pinholes, traced wavy lines on the film. From these photographic studies, new clamps for attaching the cable to the insulators were designed and vibration practically eliminated.

Tests of the towers were unprecedentedly severe. Not satisfied after scale-model investigations that the towers were capable of withstanding stresses caused by possible snapping of cables due to storm, earthquake, or wear, engineers had an actual tower built at Pittsburgh and tested in the largest test frame in the country. Here the tower was twisted and strained and pushed out of shape by punishment far more severe than anything it would encounter in field conditions.

No towers were built until the tests were completed, but progress since that time has been rapid. Within a few months, switches will be closed and Los Angeles will be receiving its electric power, generated at the world's greatest dam, over the world's greatest transmission line.

THIS TWO-TUBE SET HAS ONLY ONE TUBE

(Continued from page 64)

be to make the proper connections to the seven-prong socket for the duplex tube. However, if you follow the bottom-view drawing of the socket given on this page, even this should give no great amount of trouble. Bear in mind that the 6F7 is in reality two tubes and follow the numbers given in the drawings; the proper connections will be made automatically.

To simplify the construction and wiring, the metal chassis and panel are made to serve as a common—B and ground lead. Chassis connections are indicated in the drawing by the usual convention for a ground. The positive terminal for the heater also should be connected to the chassis as shown.

If desired, the expense of having to renew the A batteries or having a six-volt storage battery recharged can be eliminated by using a six-volt heater transformer as shown in the second diagram. If this method of construction is followed, however, several changes must be made in the circuit as indicated. Also, the positive heater terminal then should not be grounded and the heater switch should be on the 110-volt side of the transformer.

As in all receivers of this type using a 3 to 35 micromicrofarad equalizing condenser in the antenna lead, some adjustment may be necessary each time the coil is changed. First, insert the coil and manipulate the regeneration control and tuning condenser. If the circuit does not oscillate over the full range of the tuning dial, adjust the screw on the equalizing condenser until it does. In some cases, where a steady, fixed antenna is used, this antenna condenser can be eliminated.



ALMOST every man is apt to get a good idea once in a lifetime—some people have many of them. But only a few are ever put to use for the benefit of humanity and profit to the inventor. There are reasons for this. Many "good" inventions aren't practical. They would cost more than they could ever be worth. Others are allowed to die at birth—their inventors don't take them seriously. Still others need improvement and their inventors are too short-sighted to work them out. But—and this is **IMPORTANT**—those who have good, practical inventions, can often secure patent protection and even big rewards.

The FREE book shown here has been calculated to hundreds of men. It is not for the idle curiosity seeker. It is a **PRACTICAL** book, a **MAN'S** book, filled with **FACTS** about inventions and patents—a book which may help you if you have an invention and are serious about it. Ever since 1907 we have helped inventors throughout the world. We have advised them, answered their questions, secured Patent Protection for many of them. We have acquired a tremendous amount of practical patent experience which enables us to do a real job for the inventor of today.

First of all, if you have an idea for an invention, try to decide whether or not it would be worth anything to the public and to you. Then, if your answer is "Yes," write us for a copy of this book. Furthermore, you should be ready. Reasonable speed is often an advantage in an invention. Our book will tell you how we work about our 4-year patent fee plan. The kind of valuable information whether you decide you want us to handle your invention or not. A copy will be in your hands in just a few days if you get the coupon off to us **NOW**.

VICTOR J. EVANS & CO.
Registered Patent Attorneys
Main Office: 642-N Union Building,
Washington, D. C.
Other offices: 1000-1001 Chicago Bldg., Chicago, Ill.; 100-101
Bldg., New York; 101-102 Bldg., Philadelphia; 1001-1002 Bldg.,
San Francisco.
I am interested in your book, **PATENT PROTECTION**,
and I will send you my name and address without obligation on my part.
Name _____
Street and No. _____
City or Town _____ State _____

Interesting **NEW BOOK** will be sent **FREE** to men who
are serious about

INVENTION

Remarkable New Foods From the Test Tube

(Continued from page 12)

In the corn were uniting with the iron which had penetrated the tin plating from the steel of the cans and thus formed iron sulphide. By enameling the interior of the cans, the packers overcame the difficulty. Today, deformed aluminum cans are being brought out as a further aid in this development.

A cardboard carton, impregnated with sulphur, is another recent advance in packing. A New York City experimenter produced the new containers. The sulphur not only strengthens the boxes but also is expected to prove of value in preventing the growth of fungi when fruit and vegetables are packed in them.

A MYSTERY in connection with icing food products for their preservation was recently solved by laboratory tests. Quick freezing, now widely employed, retains the flavor and appearance much better than slow freezing. Why? The experiments showed that slow freezing forms large ice crystals that break down the cell structure of a product and result in loss of flavor and color when thawing takes place. Quick freezing, on the other hand, produces small crystals that leave the cells unchanged.

The development of mobile freezing plants, producing temperatures as low as fifty degrees below zero, Fahrenheit, has made it possible to take these rolling refrigerators into the orchards and fields to pack the farm products when they are most delectable. Both fish and meat are now preserved by similar rapid freezing.

When are peas ripe? That question recently brought about involved tests in a laboratory and resulted in a new method of determining exactly when these garden vegetables are most fit for canning. The peas are subjected to a hot bath containing eighty

percent alcohol. This bath dissolves the sugars and the proportion of sugars dissolved to the starches, proteins, and fiber gives an accurate index of the suitability of the peas for canning. With fish, freshness is ascertained by measuring the amount of acid necessary to neutralize the products of decomposition. Further addition of acid shows the degree to which the proteins have broken down. The fresher the fish, the more readily the acid is absorbed.

Battling fungi, bacteria and stubborn chemical affinities that threaten the flavor, color, and wholesomeness of foods is a prime job of the research worker. Often he has to sift evidence and follow clues like a scientific sleuth in tracing the cause of trouble to its source.

A case in point is reported from California.

BLUE mold began appearing upon oranges coming from one packing plant in the southern part of the state. The packer was using every precaution he could think of to protect the citrus fruit from contamination. In despair, he called in an industrial chemist to solve the riddle of the mold. This expert put his finger upon the curious source of the trouble after a quick inspection of the plant. Workers, he found, were in the habit of moistening their fingers with a squashed orange sailed to a post to help them pick up the tissue paper wrappers in which they placed the fruit. Thus one moldy orange transmitted the fungus infection to thousands of others. As soon as the workers changed their method of moistening their fingers, the trouble disappeared.

The type of contamination most dreaded of all, and the one against which the food expert is always on his guard, is caused by the bacteria which produce botulism. In

widely separated parts of the country three cases of this disease recently gave added emphasis to the necessity of cleanliness in plants where foods are manufactured or packed.

Most of the trouble of this kind nowadays arises from improperly canned home foods. Manufacturers are constantly setting up new safeguards against contamination in their factories. Housewives are advised to cook all home-canned vegetables at least thirty minutes before tasting or eating and to prepare such vegetables for canning in steam pressure cookers to prevent bacteria from entering.

Candy that literally exploded not long ago presented a curious problem to research food specialists. Yeast in the chocolate candy, they discovered, was producing internal pressure within the outer coating by making the materials rise just as bread dough does. Keeping the candy at a lower temperature in the factory overcame the difficulty.

Candy without sugar, flour without starch are to-day-turvy products of the laboratory designed to meet the requirements of those who must have a sugar- or starch-free diet.

Strangest of all is the proposal of a New York physician. He has been carrying on experiments with a view to supplanting solid foods with nourishing gases! Someday, he suggests, mankind will obtain food in vapor form and chewing will be unnecessary!

Whether the time will ever come when men will inhale their planked steaks or find the table set with neatly arranged tubes holding, in gaseous form, the elements of a seven-course dinner, remains for the distant future to determine.

At present, however, the crack army that fights in the laboratory is producing new foods, pure foods, foods of increasing nutrition. It is winning the battle for better foods for us all.

Raccoons for Hunters Grown on State Farm

(Continued from page 17)

colled nuts, corn meal, ear corn, dried bread, and tomatoes also are fed. In the wild state, a coon is his own fisherman. He will capture fish, crayfish, and mussels. Although an expert swimmer, he cannot dive and chase his prey under water.

The Milan raccoon farm consists of about 600 cubical pens made of chicken wire on wooden framework, and arranged in orderly rows. In each pen there may be two or three males, but each female has her own apartment. The young are born in early spring, there being one to five in a litter. They normally remain with their mother during the first year. For several weeks after birth of the young, the females cannot be disturbed. If they are, they will kill their young by dragging them about in an effort to hide them from the approach of intruders.

In addition to raccoons, the state raises rabbits and a limited number of pheasants at the Milan farm. It is necessary to keep on duty a professional hunter who spends his time shooting and trapping weasels, owls, hawks, and other predatory animals that prey upon the rabbits and birds. However, no



Curiosity is an amusing characteristic of raccoons, as this unusual picture indicates

such service is required at the raccoon section because the average coon can take care of such intruders without assistance.

Last spring there were 676 raccoons on the Milan farm. Their offspring probably will total 1,500. In the fall most of the young animals, together with some older ones, will be liberated. Enough young ones will be

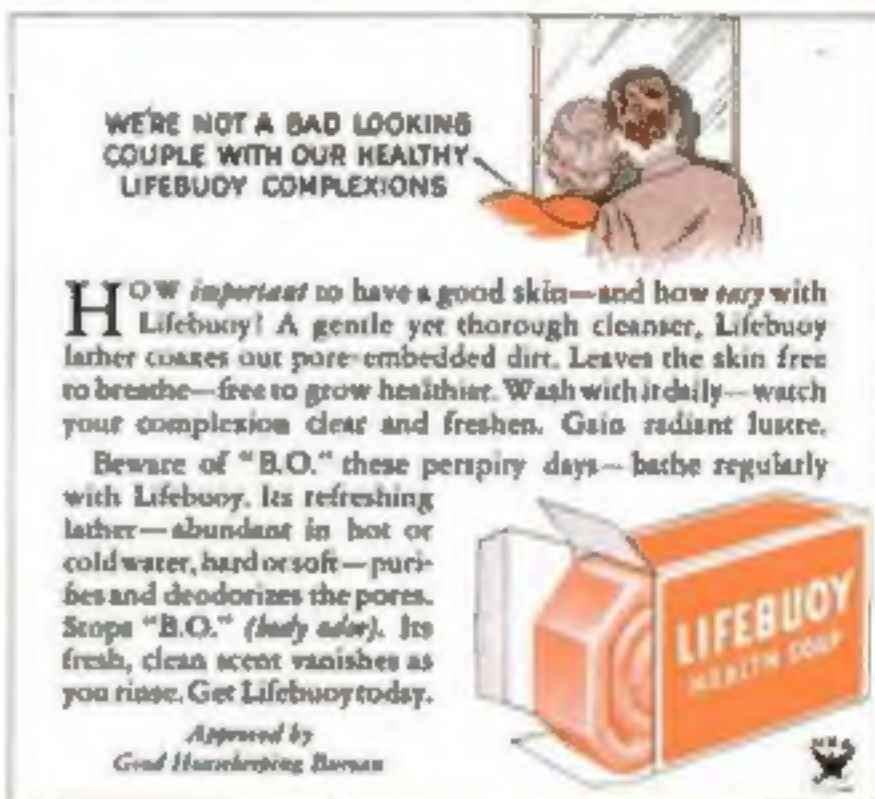
kept to assure an adequate breeding stock. The value of the raccoons to be released runs into thousands of dollars. Although exact prices cannot be quoted, the hunter who captures a gray coon this fall probably can get from \$4 to \$5 for its pelt. If he gets a part-black coon, he can sell its pelt for around \$6 and if his luck is unusually good, he will buy a pure black one that will net him \$7.

The Ohio raccoon farm is in many ways a pioneer institution. It is regarded as an excellent example of the way in which desirable wild animals can be saved from extinction. As the population of the United States grows more dense, it becomes more difficult for wild animals and birds to exist. People unintentionally destroy natural sources of food and protection, with the result

that the native animals must either adapt themselves to new conditions or perish.

Because raccoons can be raised in captivity with perhaps a greater degree of success than most other animals, coon farming some day may be an industry of considerable size. Already, many persons are picking up extra dollars by raising coons.

ABSENCE MAY MAKE THE HEART GROW FONDER BUT...



THERE ARE SHAVES THAT MAKE YOU HAPPY

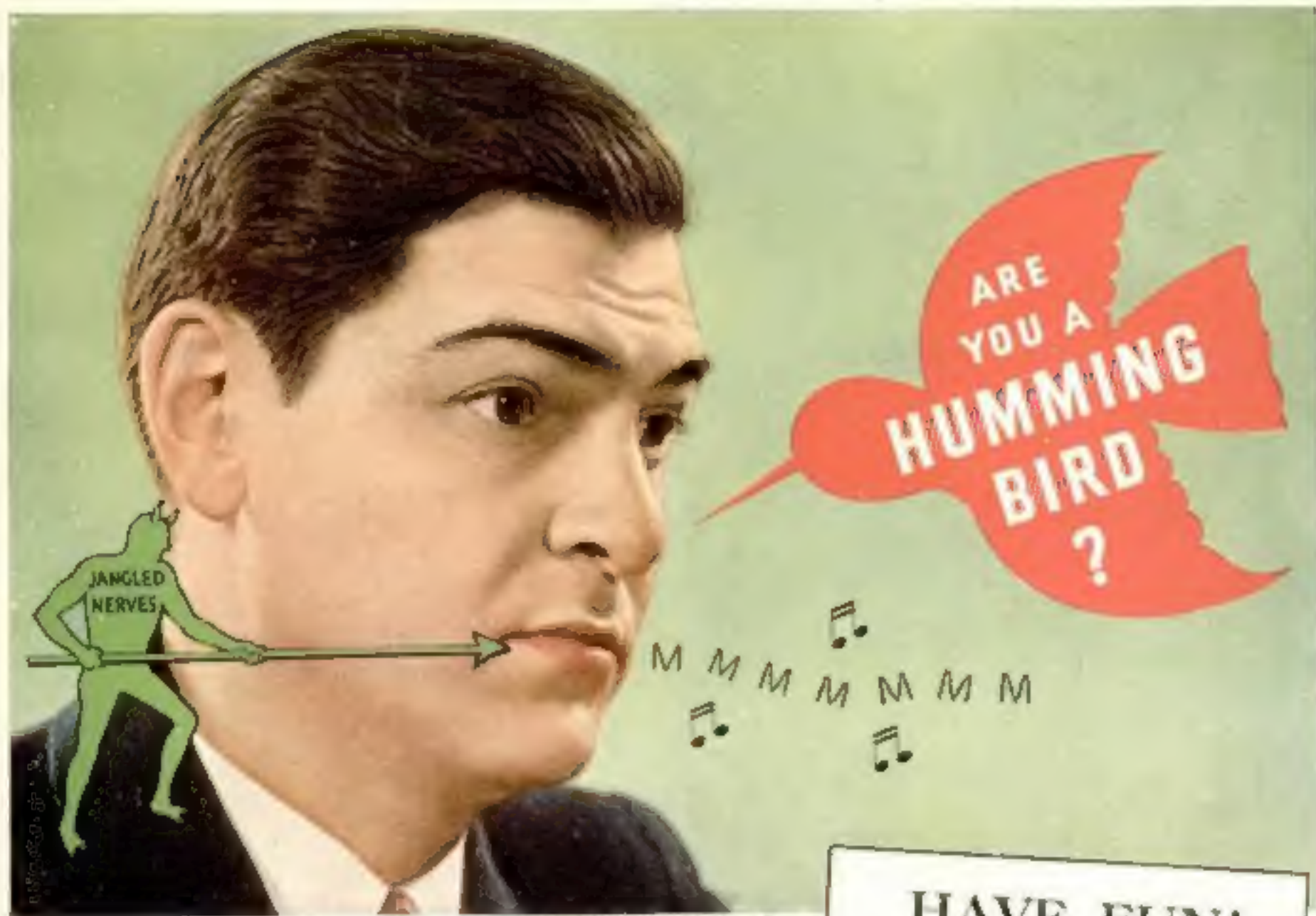


**No beard too tough
—no skin too tender
for this 52% "moister" lather**

BEARDS can't come too tough for Lifebuoy Shaving Cream. Its lather holds 52% more moisture—wills the wiriest whiskers quick—makes light work for the razor. Gives clean, easy, long-lasting shaves—soothes tender skin.

Send for FREE trial tube
Write to Lever Brothers Co., Dept. A-117, Cambridge, Mass., for a free 12-day trial tube. (This offer good in U. S. and Canada only.)





It's irritating and it means...jangled nerves

Yes, it's irritating to listen to that constant, tuneless humming—and more than that, the humming is a sign of jangled nerves.

If you notice any of those telltale nervous habits in yourself—if you whistle through

your teeth—drum on the table—then it's time to start taking care of yourself.

Get enough sleep—fresh air—recreation—and watch your smoking... Remember, you can smoke as many Camels as you want. Their costlier tobaccos never jangle your nerves.

COSTLIER TOBACCOS

Camels are made from finer, MORE EXPENSIVE TOBACCOS than any other popular brand of cigarettes!



CAMELS

SMOKE AS MANY AS YOU WANT
...THEY NEVER GET ON YOUR NERVES

HAVE FUN! Send for FREE Game Book

New—illustrated book of 20 ways to test nerves... Fascinating! Amazing! "Show up" your friends. See if you have healthy nerves. Send fronts from 2 packages of Camels with order—blank below. Free book is sent postpaid.



CLIP HERE...MAIL NOW

R. J. REYNOLDS TOBACCO COMPANY
Dept. 25-B, Winston-Salem, N. C.

I enclose fronts from 2 packs of Camels.
Send me book of nerve tests postpaid.

Name.....
FIRST NAME

Street.....

City..... State.....
offer expires December 31, 1934